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Final Technical Report

NASA/OAI Collaborative Aerospace Internship and Fellowship Program

NASA Cooperative Agreement
NCC3-473

May 1, 1996 - May 22, 1997

Ohio Aerospace Institute
22800 Cedar Point Road
Brook Park, Ohio 44142

February 1998

NASA/OAI Collaborative Aerospace Internship and Fellowship Program

NCC3-473

Summary

The NASA/OAI Collaborative Aerospace Internship and Fellowship Program is a collaborative undertaking by the Office of Educational Programs at the NASA Lewis Research Center and the Department of Workforce Enhancement at the Ohio Aerospace Institute. This program provides 12 or 14 week internships for undergraduate and graduate students of science and engineering, and for secondary school teachers. Each intern is assigned a NASA mentor who facilitates a research assignment. An important aspect of the program is that it includes students with diverse social, cultural and economic backgrounds.

The purpose of this report is to document the program accomplishments for 1996.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM

WORLD WIDE WEB - DATABASE INTEGRATION

Jason Terry
Rensselaer Polytechnic Institute
Computer Engineering
Senior
Steve Eubanks

Web based forms integrated with databases provide a fast and fully automated mechanism to replace paper forms. The use of such an interface eliminates the need to redistribute paper forms, due to the fact that the entire submission process is completed electronically. The benefits of using the web based forms to replace paper forms will be discussed, as well as the implementation of several Lewis request forms on the web.

**NASA/OAI COLLABORATIVE AEROSPACE
INTERNSHIP & FELLOWSHIP PROGRAM
NCC3-473
GRANT CLOSE OUT REPORT**

The NASA/OAI Collaborative Aerospace Internship and Fellowship Program provides 12-14 week internships for students majoring in science or engineering. The internships provide students with introductory professional experiences to complement their academic programs. The interns are given assignments in research and development under the personal guidance of NASA mentors. Besides the research assignment, the summer program includes a strong educational component which enhances the professional stature of the participants. The educational activities include a research symposium and a variety of workshops, seminars and lectures.

The program is detailed through a chronological calendar, followed by abstracts detailing the research the students participated in while at Lewis Research Center.

Nov., 1995 Two thousand applications were distributed nationwide, for the 1996 NASA/OAI Collaborative Aerospace Internship and Fellowship Program

Jan.31, 1996 Application Deadline. Applications were reviewed to ensure that applicants were qualified and had submitted complete application packages. Application information was then entered into the database and the applications were filed. In 1996, ~500 applications were received.

April 9, 1996 The NASA mentors selected 118 students from the pool of applicants. The selection varies from year to year because it is based on the mentors' needs and funding. The mentors review the applications, taking into consideration the applicant's course work, GPA, experience, background, faculty endorsement, and why the applicant wants to work at NASA. The mentors make their selections based on what qualifications they are looking for, and what an applicant has to offer to NASA.

Once a mentor makes a selection, a write-up of the assignment and a Purchase Request is submitted to the Office of Educational Programs. When the funding and assignment have been approved, OAI sends the candidate an offer letter and a copy of the assignment. The candidate must then indicate acceptance. Candidates who accept are then sent a confirmation letter and, if applicable, a housing list to assist in locating temporary housing. If a candidate declines the offer, the mentor will then make another selection.

April 23, 1996 Mentor Workshop was conducted. The workshops are designed to provide information regarding effective mentoring.

- May 13, 1996 The First Student Orientation Session for 1996 was held in the Administration Building, NASA Lewis. Orientations are held to acquaint the interns with the specifics of the program. Representatives of the Computer Services Division, Library Branch, and the Safety Assurance Group addressed the groups.
- May 24, 1996 Payday. Paychecks were distributed biweekly to all interns and high school teachers.
- May 28, 1996 The Second Student Orientation Session for 1996 was held.
- June 6, 1996 The First Networking Activity was held at the Guerin House, on the NASA grounds. The purpose of this activity is to give the students an opportunity to meet each other and talk about assignments, educational programs, and social interests, etc. Approximately 50 students attended the event.
- June 7, 1996 Payday. Paychecks were distributed biweekly to all interns and high school teachers.
- June 10, 1996 The Third Student Orientation Session for 1996 was held.
- June 17, 1996 The Fourth Student Orientation Session for 1996 was held.
- June 19, 1996 Presentation Workshop. The workshop is designed to equip interns with tools to assist them in preparing and presenting a technical presentation. Dr. Theo Keith was the workshop presenter. Approximately 111 interns and SHARP students attended the workshop.
- June 20, 1996 The second Networking Activity was held at the Guerin House, on the NASA grounds.
- June 21, 1996 R & T Briefing, held at the OAI Auditorium.
- June 21, 1996 Payday. Paychecks were distributed biweekly to all interns and high school teachers.
- June 27, 1996 Reception. All interns, Mentors, NASA Senior Management, OAI Management were invited to interact with students on an informal basis to discuss education programs and assignments. Students from SYETP, NASA Plus, SHARP, FJF, and past interns who are currently employed at NASA were invited to attend the Reception. Approximately 300 people attended the reception.
- July 2, 1996 Tours. Tours are held annually for all students. All interns were invited to attend a tour of the NASA Lewis Research Center. Participants toured the Visitor Center, the Hangar, 10' X 10' Supersonic Wind Tunnel, Battery Test Facility, Microgravity Materials Science Laboratory, Research Analysis Center, and the Propulsion Systems Facility.

- July 3, 1996 Tours. All past participants were invited to attend a tour of the NASA PlumBrook facility.
- July 3, 1996 Tours. Tours are held annually for all students. All interns were invited to attend a tour of the NASA Lewis Research Center. Participants toured the Visitor Center, the Hangar, 10' X 10' Supersonic Wind Tunnel, Battery Test Facility, Microgravity Materials Science Laboratory, Research Analysis Center, and the Propulsion Systems Facility.
- July 5, 1996 Payday. Paychecks were distributed biweekly to all interns and high school teachers
- July 9, 1996 Annual Student/Mentor Picnic. The picnic provided a social atmosphere for students and mentors to interact with one another, challenge each other in games, and to eat together. Three hundred students and mentors attended the picnic.
- July 10, 1996 Professional Development Workshop. Workshop speaker was Debbie Fatica, from Case Western Reserve University. Workshop topic: Constructing a Professional Resume and The World of Interviewing. Students received excellent information to polish resume writing and interviewing skills.
- July 16, 1996 The Scholar's Workshop This workshop provides provides a forum for the scholars to interact with each other and to discuss various pertinent issues.
- July 18, 1996 Research Symposium I. The Intern Research Symposium was initiated in order to provide NASA/OAI summer interns with an opportunity to present their summer research activities to peers and mentors. The symposium simulated a technical conference. The participating interns gave 15 minute presentations in scheduled sessions. Furthermore, all participants were asked to provide a brief summary of their presentations.
- July 19, 1996 Research Symposium I. Symposium continued a second day.
- July 19, 1996 Payday. Paychecks were distributed biweekly to all interns and high school teachers
- July 26, 1996 R & T Briefing, held at the OAI Auditorium.
- Aug. 2, 1996 Payday. Paychecks were distributed biweekly to all interns and high school teachers
- Aug. 2, 1996 OEP High School Students Awards Picnic. Students from the NASA Plus, High School/Tech, and SYTEP Programs, along with their mentors attended an award picnic at the NASA picnic area. Approximately 50 people attended.
- Aug. 8, 1996 Research Symposium II.
- Aug. 9, 1996 Research Symposium II

Aug. 16, 1996 Payday
Aug. 30, 1996 Payday
Sept. 13, 1996 Payday
Sept. 27, 1996 Payday

The success of this program requires a great deal of planning, organizing, communicating, and evaluating from the beginning through the completion of the program. Beginning in January, the program team meets regularly to ensure that the program is progressing on schedule.

In addition, there are literally hundreds of phone calls from college representatives, students, and parents inquiring about the NASA/OAI Internship Program. Students want to know the eligibility requirements, how to apply, how they can get an application, and if they were not selected, how can they improve their chances of being selected the following year, etc.

Management and administration of the program is performed in a team-like manner. The following provides the management structure for the program.

OAI

Program Director: Theo G. Keith, Ph.D.
Program Manager: Yvonne Jeans

NASA

Program Director: Jo Ann Charleston
Program Manager: Sylvia Merritt

Application 1996



NASA/OAI Collaborative Aerospace Internship and Fellowship Program

1996 SUMMER INTERNSHIP FOR STUDENTS OF SCIENCE OR ENGINEERING

at the

**NASA Lewis Research Center
Cleveland, Ohio**

Program Description

This is an educational program that provides twelve or fourteen week internships for students of science or engineering. Internships are available for a choice of starting dates during the summer of 1996 at the NASA Lewis Research Center, Cleveland, Ohio. The internships are offered under the auspices of the NASA/OAI Collaborative Aerospace Internship and Fellowship Program, a collaborative undertaking by the Office of Educational Programs at the NASA Lewis Research Center and the Department of Workforce Enhancement at the Ohio Aerospace Institute (OAI).

The internships are intended to provide students with introductory professional experiences to complement their academic program. Interns are given assignments in research and development projects under the personal guidance of NASA professional staff members. Assignments are commensurate with the academic level and field of study of the student.

Interns are integrated into the day-to-day activities of the Center to the greatest extent possible. A certain amount of time is devoted to a program of scheduled professional and social events.

Lewis Research Center

The NASA Lewis Research Center occupies a 350-acre site adjacent to the Cleveland Hopkins International Airport. It provides a campus-like environment with over 170 buildings and structures, including offices, laboratories, wind tunnels, test cells, computing centers, and other research facilities. These structures are supported by an extensive computer network, including computational, computer support, and communications facilities. Approximately 4,000 civil service, contractor and visiting personnel, almost half of whom are scientists or engineers, work at the site.

The Lewis Research Center has been designated by NASA as a Center of Excellence in the following areas: Aeronautical Propulsion, Space Power, Space Communications, Space Nuclear Propulsion Systems, Space Electric Propulsion Systems and Microgravity Science, which includes Fluid Physics, Combustion Science and Material Science. The designation assigns the responsibility for producing research and technology advances in the given areas and for providing extended programmatic leadership, from research and technology to system development. NASA has also designated Lewis as a participating center in space chemical propulsion and is expected to contribute to both basic and focused technology. Lewis is also responsible for delivering intermediate and large-class expendable launch vehicle services for assigned missions.

The Ohio Aerospace Institute

The Ohio Aerospace Institute is a university, industry, and government consortium established to promote collaborative research, graduate and continuing education, and the adaptation of advanced technology for industry.

The consortium includes nine Ohio universities, NASA Lewis Research Center in Cleveland, Wright-Patterson Air Force Base in Dayton, and major corporations.

OAI's mission is to foster the growth and competitiveness of high technology industry in Ohio and to help graduate more students in science and engineering.

In October 1992, this non-profit consortium opened a new building next to the NASA Lewis Research Center and Cleveland Hopkins International Airport. The \$10.7 million three-story glass-and-steel structure offers 70,000 square feet for research and educational purposes.

Eligibility

Internships are available only to U.S. citizens who are full-time students pursuing a baccalaureate or higher degree in a field of science engineering at an accredited college or university throughout the United States. College-bound high school graduates or 2-year college students with demonstrable plans to pursue baccalaureate degrees are also eligible. Students must have a cumulative GPA of 3.0 or 4.0 scale.

Application

Students seeking internships must submit an application to the Ohio Aerospace Institute. All students are required to serve a tenure of a period of 12 or 14 weeks. The period of tenure is determined by the students and has no effect on selection. The internships do not provide for vacation time and such time should be scheduled outside the tenure period. Students are required to be present for 12 or 14 weeks and will not be permitted to take any summer classes outside of Lewis during the internship. Students are expected to adhere to the tenure period and dates specified on their application. Application forms or additional information may be obtained by contacting:

NASA/OAI Internship/Fellowship Program

Attn: Ashanti Trent

Ohio Aerospace Institute

22800 Cedar Point Road

Cleveland, Ohio 44142

Telephone: (216) 962-3170 x 5006

Applications will be accepted beginning December 1, 1995 and must be postmarked no later than January 31, 1996.

A complete application package must include:

- | | |
|---------------------------------------|---|
| 1. A completed and signed application | 3. Faculty endorsement |
| 2. Transcript(s) | 4. List of courses currently being taken (Winter/Spring 1996) |

(Faxed copies are unacceptable)

All applications postmarked after January 31, 1996 will not be considered.

All applicants not selected to participate in the program will be notified by April 15, 1996.

Selection Criteria

Selection in this program is very competitive and is based on the following:

- | | | |
|-------------------------------|---|--|
| 1. R & D organizational needs | 2. Academic level and relative coursework | 3. Performance background and research interests |
|-------------------------------|---|--|

Salaries

Interns receive a biweekly salary for their appointments. The amount of the salary depends on the academic standing achieved by the student at the time tenure begins. For 1996, the biweekly salary payments are:

Academic Standing:	Freshman/Sophomore	• Junior/Senior	• Master/Doctoral Student
Amount:	\$ 560	\$ 680	\$ 1100

The normal statutory withholdings will be withheld. The tax portion withheld will depend on the tax status of each individual.

Travel Allowances

One round trip travel reimbursement is provided to students whose city of permanent residence is more than 50 miles from Cleveland and who relocate for the program. Reimbursement is based on shortest-route mileage at 25 cents per mile and is paid after tenure begins.

Housing

Students must make their own housing arrangements. This program does not provide living expenses. If a list of short-term accommodations is desired, check the appropriate box on signature page.

Please understand that the housing list has been assembled for your convenience from responses to newspaper advertisements we have placed in local newspapers for accommodations for our summer visitors. We have not checked these accommodations and do not advocate them over other accommodations you may find on your own.

Schedule

Applications must be postmarked no later than January 31, 1996 to assure consideration.

Application Deadline: January 31, 1996

Application Notification: April 15, 1996

Possible Starting Dates: May 13, 1996

(Monday, May 27 is a holiday) May 28, 1996

June 10, 1996

12 Week

August 2, 1996

August 16, 1996

August 30, 1996

End Dates

14 Week

August 16, 1996

August 30, 1996

September 13, 1996

NASA/OAI Collaborative Aerospace Internship and Fellowship Program

APPLICATION FOR 1996 SUMMER INTERNSHIP

Please type or print in black ink only

Name: _____

Social Security Number: _____

Date of Birth: _____

Place of Birth: _____

Home Address: _____

☐ Work Address ☐ School Address

Telephone: () _____

Telephone: () _____

E-Mail Address: _____

Please indicate address you would like correspondence mailed to: (Give dates only if both are checked.)

☐ Home From: _____ To: _____

☐ School From: _____ To: _____

Current School:

☐ High School ☐ College ☐ University Name: _____ City, State: _____ Date Began: _____ Planned Graduation Date: _____

If you have applied to attend an undergraduate or graduate college/university for the fall 1996, please provide the following:

Planned College or University: _____ Field of Study/Targeted Degree: _____ Status of Application: _____

☐ Pending

☐ Accepted

Check here if you will be a 1996 high school graduate ☐ (12) Academic Level as of Fall 1996: (Check one)

Cumulative Grade Point Average: _____ out of 4.0
 (Minimum requirement: GPA 3.0 on a 4.0 scale)

- ☐ (13) College Freshman
- ☐ (14) College Sophomore
- ☐ (15) College Junior
- ☐ (16) College Senior
- ☐ (17) Master Student
- ☐ (18) PhD Student

Credit hours earned as of June 1996:
 _____ out of _____

Academic Major: _____

For placement purposes, please indicate the field of science or engineering in which you would like to intern. Dual majors must indicate a first and second choice, in order of preference.

- ☐ (1) Aero/Astro Engineering
- ☐ (2) Architecture
- ☐ (3) Chemical Engineering
- ☐ (4) Chemistry
- ☐ (5) Civil Engineering
- ☐ (6) Computer Science/Engineering
- ☐ (7) Electrical Engineering
- ☐ (8) Environmental Science/Engineering
- ☐ (9) Industrial Engineering

- ☐ (10) Materials/Structures
- ☐ (11) Math
- ☐ (12) Mechanical Engineering
- ☐ (13) Nuclear Engineering
- ☐ (14) Optics
- ☐ (15) Physics
- ☐ (16) Polymers
- ☐ (17) Systems Engineering
- ☐ (18) Other: _____

OFFICE USE ONLY

Date Received: _____

13 14 15 16 17 18

Bi-Weekly Salary: \$ _____

Date Processed: _____

12 14

PR Requirement: \$ _____

Background Information

Work Experience: _____

Special Training or Skills: _____

Honors or Awards: _____

Hobbies and Interests: _____

Internship Research Interests: _____

Additional Information: _____

Narrative Statement

In the space below, write a narrative statement that indicates your internship research interests, and how you and NASA will benefit if you are selected.

INTERN PROGRAM

Faculty endorsement for: _____

This envelope *must* be returned to the *student* requesting recommendation.

Please seal and sign across the back flap.



Fill in your name on the endorsement form, separate it from the application form and give it, along with the enclosed envelope, to the faculty member who will provide a recommendation based on your academic ability and interpersonal skills. Because the endorsement letter must be returned with the application, set a predetermined date with the faculty member when you can pick up the letter.



FACULTY ENDORSEMENT

Student: _____

The above named student is applying for a summer internship at the NASA Lewis Research Center. The internship, if awarded, will provide an opportunity for the student to work with professional staff in an environment not unlike an academic research setting. Your endorsement of the student's participation is requested in consideration of his or her potential to both contribute to and benefit from the experience. You may use the space below or use a separate letter. Please respond by January 31, 1996.

This form should be returned by student with application in the enclosed envelope.

I ☐ recommend, I ☐ do not recommend, the above student for an internship at the NASA Lewis Research Center.

Signature: _____ Date: _____

Title: _____ Telephone: _____

Address: _____

*** Must be a faculty member in applicant's department or area of expertise***

Period of Tenure Requested: ☐ 12 Weeks ☐ 14 Weeks

From: (Monday) _____ To: (Friday) _____
(Date) (Date)

Did you apply for this program in 1995? ☐ Yes ☐ No

Have you previously participated in this program? ☐ Yes ☐ No

Check any of the following NASA or Federal programs you have participated in:

- | | |
|---|---|
| <input type="checkbox"/> (1) NASA SHARP Program | <input type="checkbox"/> (7) Ohio Space Scientists of Tomorrow Program |
| <input type="checkbox"/> (2) NASA Lewis Explorer's Post | <input type="checkbox"/> (8) Space Science Student Involvement Program |
| <input type="checkbox"/> (3) NASA Lewis Shadowing Program | <input type="checkbox"/> (9) OPM National Science Scholar |
| <input type="checkbox"/> (4) NASA Lewis SYETP Program | <input type="checkbox"/> (10) The N.A.S.A. Project at C.C.C. |
| <input type="checkbox"/> (5) NASA Lewis/East Tech Partnership Program | <input type="checkbox"/> (11) Undergraduate Student Researchers Program |
| <input type="checkbox"/> (6) KEYS Program | <input type="checkbox"/> (12) Other: |

Is any member of your family employed at NASA Lewis Research Center? ☐ Yes ☐ No

If Yes, identify the employee and the relationship: _____

References other than the faculty member providing written endorsement (name, title, telephone):

1. _____

2. _____

Please indicate whether a short-term housing list is desired. ☐ Yes ☐ No

Do we have your permission to include your name, address and phone in a listing to send to students interested in sharing housing? ☐ Yes ☐ No

Transcripts

College-bound high school students: attach a transcript of all high school courses completed and a list of courses currently being taken.

Undergraduate students: attach a transcript of all college courses completed and a list of courses currently being taken.

Graduate students: attach a complete undergraduate transcript, a transcript of all graduate courses completed, and a list of courses currently being taken.

Copies of unofficial transcripts already in your possession are acceptable. It is not necessary to have your school send official transcripts.

Applicants will be notified of the results by mail by April 15, 1996.

I certify that the information provided herein is complete and correct. I am a United States citizen.

Signature: _____ Date: _____

Send the complete application to:

NASA/OAI Internship/Fellowship Program
Attn: Ashanti Trent
Ohio Aerospace Institute
Department of Workforce Enhancement
22800 Cedar Point Road
Cleveland, Ohio 44142

BACKGROUND SURVEY

(Completion of this form is optional)

Name: _____ School: _____

☐ Student ☐ Teacher

How did you learn of the internship and fellowship program?

- ☐ (a) Previous Participation
- ☐ (b) Acquaintance who was an intern and/or a teacher
- ☐ (c) Inquiry to NASA about summer employment
- ☐ (d) Group visit to the Center
- ☐ (e) Relative who works for NASA or a NASA contractor
- ☐ (f) Acquaintance who works for NASA or NASA contractor
- ☐ (g) Participation in another NASA Program
- ☐ (h) Faculty member or school official
- ☐ (i) Other: _____

Please review the categories below and categorize yourself by checking the appropriate items.

- ☐ (1) American Indian or Alaskan Native
- ☐ (2) Asian or Pacific Islander
- ☐ (3) African-American
- ☐ (4) White
- ☐ (5) Hispanic
- ☐ (6) Other: _____

- ☐ (M) Male
- ☐ (F) Female

Disabled: ☐ Yes ☐ No

If Yes, please indicate disability: _____

The information solicited on this form will not be available to those responsible for rating applications but will be used by NASA primarily to determine the extent to which various populations are represented in the applicant pool.

APPLICATION PACKAGE CHECKLIST

Before completing this application, you should read it thoroughly. Special attention should be given to eligibility requirements, dates and deadlines.

Required information: (Check when completed)

- ☐ *Signed and completed Application*
- ☐ *Faculty Endorsement*
- ☐ *Transcripts*
- ☐ *List of courses to be taken in Winter/Spring 1996*
- ☐ *Background Survey (optional)*

**ALL COMPLETED AND SIGNED APPLICATIONS MUST BE POSTMARKED BY
JANUARY 31, 1996 and submitted to:**

NASA/OAI Internship/Fellowship Program
Attn: Ashanti Trent
Ohio Aerospace Institute
Department of Workforce Enhancement
22800 Cedar Point Road
Cleveland, Ohio 44142

Please be advised that incomplete applications will not be processed.

Intern Listing

1996 NASA / OAI Internship & Fellowship Program

Participants

STUDENT	MAJOR	SCHOOL	ACADEMIC LEVEL
ACKERMAN, MALISSA	AERO/ASTRO ENG	CWRU	COLLEGE SENIOR
ADAMSON, ROBERT	MECH ENG	RPI	COLLEGE JUNIOR
ARENAS, DAVID	MAT'LS/STRUCTURES	PENN STATE U	MASTER CANDIDATE
ATKINSON, DEREK	CHEM ENG	MOREHOUSE C	COLLEGE SOPHOMORE
BANSAL, GAURAV	ELEC ENG	CWRU	COLLEGE SENIOR
BARTLETT, AMY	COMP SCI/ENG	UNIV OF ID	COLLEGE JUNIOR
BEELER, AMANDA	MECH ENG	OHIO NORTHERN U	COLLEGE JUNIOR
BERCIER, TENNILLE	MECH ENG	CLEVE CENTRAL CATH	COLLEGE FRESHMAN
BOCKSELL, TODD	AERO/ASTRO ENG	U ILLINOIS-URBANA	MASTER CANDIDATE
BOHNAK, SHAUNA	OTHER	PADUA HS	COLLEGE FRESHMAN
BOOZER, ALICIA	ELEC ENG	SPELMAN C	COLLEGE FRESHMAN
BROWN, TANESHA	MATH	SPELMAN C	COLLEGE SENIOR
BURGOS, ISRAEL	OTHER	MAX HAYES HS	HS TEACHER
BURGOS, MARISOL	CHEMISTRY	JANE ADDAMS BCC	COLLEGE FRESHMAN
CAMBURAKO, NICHOLAS	ELEC ENG	STRONGSVILLE HS	COLLEGE FRESHMAN
COMISKEY, MICHELE	COMP SCI/ENG	KENT STATE U	COLLEGE SENIOR
CRAWFORD, MARCUS	POLYMERS	MOREHOUSE C	COLLEGE JUNIOR
CUMMISKEY, CAROL	ELEC ENG	TRENTON STATE C	COLLEGE SENIOR
DAVIS, JOSHUA	MATH	OBERLIN C	COLLEGE JUNIOR
DEGENNARO, ALFRED	OTHER	CLEVELAND HEIGHTS HS	HS TEACHER
DEMO, MELANIE	ELEC ENG	RICE U	COLLEGE SOPHOMORE
DI MAURO, LORI	AERO/ASTRO ENG	CWRU	COLLEGE SENIOR
DOTY, MICHAEL	AERO/ASTRO ENG	U NOTRE DAME	MASTER CANDIDATE
EDMONDS, BRENDA	OTHER	ASHLAND U	COLLEGE SOPHOMORE
EELKEMA, EMILY	MECH ENG	U MINNESOTA	COLLEGE SOPHOMORE
ELLIOTT-LEWIS, DANE	AERO/ASTRO ENG	GEORGIA TECH	MASTER CANDIDATE
EZOLT, PHILLIP	COMP SCI/ENG	CARNEGIE MELLON U	COLLEGE JUNIOR
FEGYVERESI, JOHN	COMP SCI/ENG	CWRU	COLLEGE JUNIOR
FISHER, VINESSIA	SYSTEMS ENG	FLORIDA A&M U	MASTER CANDIDATE
FU, HENRY	CHEMISTRY	BRECKSVILLE HS	COLLEGE FRESHMAN

STUDENT	MAJOR	SCHOOL	ACADEMIC LEVEL
FU, JOYCE	CHEMISTRY	HARVARD-RADCLIFFE C	COLLEGE SOPHOMORE
FUNK, JOHN	AERO/ASTRO ENG	PURDUE U	COLLEGE SENIOR
GILBERT, JACK	OTHER	AVIATION HS	HS TEACHER
GNEPP, ANDREI	MATH	HARVARD U	COLLEGE JUNIOR
GRAY, GARY	CHEM ENG	OSU	COLLEGE SENIOR
HEINEMAN, DAWN	PHYSICS	JAMES MADISON U	COLLEGE JUNIOR
HESS, ANDREA	POLYMERS	MANCHESTER C	MASTER CANDIDATE
HIGGS III, C. FRED	MECH ENG	RPI	MASTER CANDIDATE
HODANBOSI, CAROL	OTHER	BARBERTON HS	HS TEACHER
HUNTER, DAN	PHYSICS	MIAMI U	COLLEGE JUNIOR
INGRAM, JESSE	MECH ENG	FLORIDA A&M U	PHD CANDIDATE
JACKO JR., LEONARD	CHEMISTRY	BALDWIN WALLACE C	COLLEGE SENIOR
JACOBSEN, LANCE	AERO/ASTRO ENG	VIRGINIA TECH C	COLLEGE JUNIOR
JACOBSON, DAVID	MECH ENG	OSU	COLLEGE SENIOR
JEFFERSON, GAIL	MECH ENG	GEORGIA TECH	COLLEGE SENIOR
JOHNSON, DWAIN	MATH	OAKWOOD C	COLLEGE JUNIOR
JUST, BRIAN	MECH ENG	U MINNESOTA	COLLEGE JUNIOR
KAHLENBERG, KERRI	ENVIRON SCI/ENG	BOWLING GREEN U	COLLEGE SENIOR
KAISER, GRAHAM	AERO/ASTRO ENG	U DAYTON	MASTER CANDIDATE
KAJFASZ, TROY	ENVIRON SCI/ENG	OSU	COLLEGE SENIOR
KAO, KATY CHIA-LING	CHEM ENG	U CALIFORNIA-IRVINE	COLLEGE SENIOR
KAPP, G. PETER	AERO/ASTRO ENG	PRINCETON U	COLLEGE SENIOR
KASCAK, PETER	ELEC ENG	OHIO STATE U	COLLEGE SENIOR
KEELS, WAYNE	COMP SCI/ENG	PURDUE U	MASTER CANDIDATE
KLEINHENZ, JULIE	AERO/ASTRO ENG	CWRU	COLLEGE SOPHOMORE
KNIGHT, DONALD	OTHER	ST IGNATIUS HS	HS TEACHER
KNIGHT, JASON	MATH	CWRU	COLLEGE JUNIOR
KREJSA, ANDREW	ENVIRON SCI/ENG	VALLEY FORGE HS	COLLEGE FRESHMAN
KRIGEL, ADAM	PHYSICS	U CALIFORNIA BERK	COLLEGE JUNIOR
KUDLA, THOMAS	COMP SCI/ENG	BALDWIN WALLACE C	COLLEGE SOPHOMORE
LEON, GIADIRA	ELEC ENG	RPI	COLLEGE JUNIOR
LIENHARD, MICHAEL	CHEMISTRY	RPI	PHD CANDIDATE

STUDENT	MAJOR	SCHOOL	ACADEMIC LEVEL
LUNDQUIST, CARIN	AERO/ASTRO ENG	PRINCETON U	COLLEGE SOPHOMORE
LYNCH, DENIS	AERO/ASTRO ENG	U NOTRE DAME	MASTER CANDIDATE
MACLACHLAN, BRIAN	AERO/ASTRO ENG	U MICHIGAN	COLLEGE JUNIOR
MCDIVITT, TIMOTHY	MECH ENG	CSU	COLLEGE SENIOR
MCGUIRE, THOMAS	AERO/ASTRO ENG	PENN STATE U	COLLEGE SOPHOMORE
MCQUEEN, JEROME	ENVIRON SCI/ENG	FLORIDA A&M U	MASTER CANDIDATE
MENDELSON, BRADLEY	MECH ENG	PRINCETON U	COLLEGE JUNIOR
MIELKE, AMY	MECH ENG	U DAYTON	COLLEGE JUNIOR
MIXON, PATRICK	ELEC ENG	GEORGIA TECH	COLLEGE SENIOR
MULLER, DEREK	MECH ENG	FLORIDA A&M U	MASTER CANDIDATE
NARVAEZ, WIGBERTO	MECH ENG	PENN STATE U	COLLEGE SENIOR
NGUYEN, QUYNH GIAO	MAT'LS/STRUCTURES	NOTRE DAME C	MASTER CANDIDATE
O'MALLEY, MAURA	INDUSTRIAL ENG	ST JOSEPH ACADEMY	COLLEGE FRESHMAN
OCKUNZZI, KELLY	COMP SCI/ENG	CWRU	PHD CANDIDATE
OLSAFSKY, BARBARA	COMP SCI/ENG	HIRAM C	COLLEGE JUNIOR
ORTIZ, RONNIE	POLYMERS	CWRU	MASTER CANDIDATE
PADULA II, SANTO	MAT'LS/STRUCTURES	MICHIGAN TECH U	MASTER CANDIDATE
PAGE, SEAN	AERO/ASTRO ENG	SYRACUSE U	COLLEGE SENIOR
PAGEDAR, NITIN	PHYSICS	U CHICAGO	COLLEGE JUNIOR
PALADINO, JONATHAN	CHEMISTRY	U MISSOURI-ROLLA	PHD CANDIDATE
PANGBURN III, KENNETH	COMP SCI/ENG	MOREHOUSE C	COLLEGE JUNIOR
PIASECKI, KRISTI	MECH ENG	U DAYTON	COLLEGE SOPHOMORE
POSLOWSKI, AGNIESZKA	CHEMISTRY	JOHN CARROLL U	COLLEGE SENIOR
RICHARDSON, NIGEL	CIVIL ENG	FLORIDA A&M U	MASTER CANDIDATE
ROADS, CHRISTOPHER	OTHER	NORTH ROYALTON HS	HS TEACHER
ROBERTS, GORDON	AERO/ASTRO ENG	CCNY	MASTER CANDIDATE
ROLAND, VASHON	INDUSTRIAL ENG	FLORIDA A&M U	MASTER CANDIDATE
SALINAS, MAURICIO	MECH ENG	U TEXAS	MASTER CANDIDATE
SALVEKAR, ATUL	ELEC ENG	CA INST OF TECH	MASTER CANDIDATE
SHAW, CYNTHIA	ENVIRON SCI/ENG	FAIRVIEW HS	COLLEGE FRESHMAN
SHOGRIN, BRADLEY	MECH ENG	CWRU	PHD CANDIDATE
SIDDIQI, YUMNA	ARCHITECTURE	OSU	MASTER CANDIDATE

STUDENT	MAJOR	SCHOOL	ACADEMIC LEVEL
SELKEN, ROBERT	COMP SCI/ENG	TRINITY U	COLLEGE SENIOR
SMITH, CHRISTINA	MECH ENG	CWRU	COLLEGE JUNIOR
SMITH, QUIANA	ELEC ENG	SPELMAN C	COLLEGE SOPHOMORE
SNYDER, SCOTT	AERO/ASTRO ENG	AVON LAKE HS	COLLEGE FRESHMAN
SOKOLOWSKI, TODD	MECH ENG	OSU	MASTER CANDIDATE
SORIN, DANIEL	ELEC ENG	DUKE U	MASTER CANDIDATE
STEVENSON, CHERISSE	CHEMISTRY	SPELMAN C	COLLEGE JUNIOR
STORM, ROGER	OTHER	FAIRVIEW HS	HS TEACHER
TERRY, JASON	COMP SCI/ENG	RPI	COLLEGE SENIOR
THEIN, THAN-HTIKE	OPTICS	U MICHIGAN	COLLEGE JUNIOR
THOMAS, SONJA	ELEC ENG	CSU	COLLEGE JUNIOR
THOMAS-OGBUJI, CHIMEZIE	COMP SCI/ENG	U ILLINOIS-URBANA	COLLEGE SOPHOMORE
TIMBERLAKE, JUJUAN	MECH ENG	MOREHOUSE C	COLLEGE SENIOR
TURNER, ALLYN	ELEC ENG	U ROCHESTER	COLLEGE SOPHOMORE
VAVREK, RICHARD	ELEC ENG	U DAYTON	COLLEGE JUNIOR
VOLTZ, GERALD	OTHER	EAST TECH HS	HS TEACHER
WAGNER, KEELY	ELEC ENG	U WISCONSIN-MADISON	MASTER CANDIDATE
WASHINGTON, JR., W. CRAIG	CHEMISTRY	MOREHOUSE C	COLLEGE JUNIOR
WILLIAMS, JEFFREY	AERO/ASTRO ENG	BYU	COLLEGE SENIOR
WILLIAMS, LESLEY	CHEMISTRY	SPELMAN C	COLLEGE SENIOR
WILSON, KIMBERLY	MECH ENG	TENNESSEE STATE U	COLLEGE JUNIOR
YODER, YVONNE	CHEMISTRY	MANCHESTER C	COLLEGE SENIOR
ZAHLER, JULIA	MECH ENG	OHIO NORTHERN U	MASTER CANDIDATE
ZELLER, LAURA	ENVIRON SCI/ENG	U ROCHESTER	COLLEGE SENIOR

Total Number of Records on this Report = 118

Offer and Confirmation Letter

NASA/OAI
Collaborative Aerospace Internship and
Fellowship Program

May 3, 1996

Tennille Bercier
3264 West 25
Cleveland, OH 44109

Dear Tennille:

On behalf of the Ohio Aerospace Institute, it is a pleasure to inform you that you have been selected for an internship at the NASA Lewis Research Center in the 1996 NASA/OAI Collaborative Aerospace Internship and Fellowship Program. As usual, the competition was very intense and you are to be congratulated for having been selected. This internship is intended to provide you with research oriented educational experiences to complement your academic field of study.

The enclosed assignment sheet indicates the organization that will host you during your internship, the activities/responsibilities planned for you and the Lewis employee who will serve as your mentor. Your mentor will provide you with guidance and assistance throughout your internship. Please contact your mentor prior to your arrival so you can begin to prepare for your internship at Lewis.

The length of tenure will be 10 weeks and your starting date is planned for June 10, 1996. Your salary for the full internship period will be \$2,800.00. This amount will be paid by the Ohio Aerospace Institute in equal biweekly installments of \$560.00 beginning two weeks after you start your tenure.

Because of the tight schedule and intense competition for internships, we must have a response from you within five days of receipt of this letter if you wish to participate in the summer program. If you fail to respond by that time, we will assume you are unavailable and this offer will be withdrawn. Please notify Yvonne Jeans at (216) 962-3036 or via e-mail, YvonneJeans @oai.org, of your acceptance of this offer, and specifically confirm your dates of participation. In addition, please sign the bottom of this letter and forward the original to the Ohio Aerospace Institute, Attention: Yvonne Jeans, Department of Workforce Enhancement, 22800 Cedar Point Road, Cleveland, Ohio 44142 to acknowledge your acceptance of the terms and conditions of this offer.

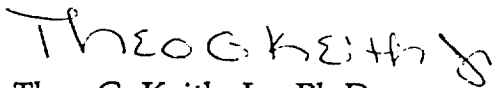
The main entrance to the Lewis Research Center is on the south side of Brookpark Road at the western end of Cleveland Hopkins International Airport. It can be reached from the Grayton Road exit of Interstate 480. Two maps are enclosed to assist you.

Plan to arrive at 8:00 a.m. on your starting date. Stop briefly at the main gate by the guardhouse for directions to the Administration Building and the Hanger Parking Lot which is located just across Taylor Road. For identification and admission to the Center, you must bring this letter with you. The receptionist at the entrance of the building will direct you to the room where we will issue you a badge and conduct an orientation meeting. The meeting will begin at 8:30 a.m.

All interns/fellows will be regarded as professionals for which business dress is always appropriate. Shorts are strictly prohibited at your worksite. In addition to performing your internship assignment, you can expect to participate in professional and social activities. These activities will be briefly described at the orientation.

We look forward to your arrival. If you wish additional information, please do not hesitate to contact Yvonne Jeans at (216) 962-3036 or Sylvia Merritt at (216) 433-5574. If you require more information about your responsibilities as an intern, we suggest that you contact your mentor at the number listed on the enclosure.

Sincerely,



Theo G. Keith, Jr., Ph.D.
Vice President of Workforce Enhancement
(216) 962-3030

Enclosure

cc: OAI/Yvonne Jeans
9200/Official File
86-10/Kelly Carney

I accept the assignment as stated above

Tennille Bercier

Date

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP PROGRAM

ASSIGNMENT FORM

Intern/Teacher: TENILLE BERCIER

Org Code: 4310 Branch: STRUCTURAL SYSTEMS DYNAMICS

Division: STRUCTURAL SYSTEMS

Mentor: KELLY S. CARNEY Telephone: (216) 433- 2386

Activities/Responsibilities: _____

1) INTERN WILL ASSIST IN ICING

DYNAMICS RESEARCH LAB

2) INTERN WILL ASSIST IN STRUCTURAL

DYNAMICS LAB

3) INTERN WILL PERFORM ANALYTICAL

TASKS IN SUPPORT OF CASSINI MISSION

Research Symposium I

Student Abstracts

Research Symposium Session I
Schedule and Abstracts
Thursday, July 18, 1996
Auditorium

9:15 Vinessia Fisher, "Development of a Search Engine for the Expertise File of the Lewis Experts"

9:30 Derek Muller, "Theory of Magnetic Bearing Control"

9:45 Kimberly Wilson, "Experimental Investigation of In-Service Performance Loss in Transonic Axial Flow Compressors Due to Blade Deterioration"

10:00 John Fegyveresi, "A Closer Look at Formal Inspections"

BREAK

10:30 Fred Higgs, "The Globalization of Interactive X-Based Engineering Software Applications"

10:45 Kerri Kahlenberg, "The Implications of Title V of the Clean Air Act (1990) to NASA-LeRC"

11:00 Wigberto Narvaez, "Space Station Fluids and Combustion Facility"

11:15 Bob Sielken, "TRACKER: A Digitized Image Object Tracking System"

LUNCH (on your own)

**NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND
FELLOWSHIP PROGRAM**

“Development of a Search Engine For the Expertise File of the Lewis Experts Database”

Vinessia T. Fisher
Florida Agricultural & Mechanical University
Industrial Engineering
Masters Graduate
Mentor: Dr. Larry A. Viterna

ABSTRACT:

A search engine has been developed to search the expertise of NASA employees and contractors using the information provided in the Lewis Experts Database for the purpose of assisting the employees when various disciplines of expertise are needed. The search engine accepts two types of search constructs (“and/or”) which allows the user greater flexibility in performing a particular search. There may be times when a more specific search (“and”) is needed, and other times when a much broader search (“or”) will suffice.

The actual programming languages and software utilized will be discussed as well as a specific example showing the different results obtained depending on the specific search criteria. This project allows the employees to utilize, first, the expertise here at the site before going elsewhere, which could possible save much time and money, thereby making it extremely efficient and necessary.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM

EXPERIMENTAL INVESTIGATION OF IN-SERVICE PERFORMANCE LOSS IN
TRANSONIC AXIAL FLOW COMPRESSORS DUE TO BLADE DETERIORATION

Kimberly M. Wilson
Tennessee State University
Mechanical Engineering
Undergraduate, Senior
Mentor: Dr. Kenneth L. Suder

ABSTRACT

In the airline industry, there is a concern about in-service performance loss due to parts deterioration. In order to better understand causes of this performance loss, an investigation was done using a high speed axial compressor rotor, laser anemometry and predictions generated by a quasi-3D Navier-Stokes flow solver. Measurements for different surface roughness and airfoil thickness were taken at 60%, 80% and 100% of rotor design speed. Results showed that increasing roughness and thickness to the rotor blade surfaces causes an additional thickening of the blade boundary layers, which leads to increases in blockage and a significant loss in overall performance. Understanding why blade deterioration decreases the performance may lead to new cost-effective strategies and replacement intervals as well as new design and manufacturing strategies to minimize this performance loss.

**NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM**

A CLOSER LOOK AT FORMAL INSPECTIONS

John M. Fegyveresi
Case Western Reserve University
Computer Engineering
Junior
Mentor: **Martha S. Wetherholt**

ABSTRACT:

By designing an independently executable, portable, electronic database, the process of formal inspection data entry has been vastly facilitated. Formal Inspections, or structured, well defined review process for finding and correcting defects, were previously recorded tediously via a pen and paper. At an inspection, a selected team of trained individuals with assigned roles, comes together for approximately two hours and by incorporating TQM principles, literally inspects software for defects and prompts corrections during the early life cycle phases. This process improves the overall efficiency of the product and reduces the cost of fixing problems later on.

**NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM**

**THE GLOBALIZATION OF INTERACTIVE X-BASED ENGINEERING SOFTWARE
APPLICATIONS**

**C. Fred Higgs III
Rensselaer Polytechnic Institute
Mechanical Engineering
Masters
Mentor: Thomas Benson**

Sharing technology is an increasing advantage and major goal at NASA. As an ongoing project in this initiative, interactive aeronautical and mechanical engineering software has been designed for education and industrial purposes. Graphical User Interfaces (GUIs) have aided engineers in designing more expedient tools to perform computations, improve visualization capabilities, and effectively serve as tools for engineering education. GUI software applications in the area of thermal fluids and aerospace science have been designed. However, the availability of this software is limited to large X-based UNIX and X-emulator environments. It has been a goal of the intern to globalize these applications by designing new versions applicable to PC platforms (i.e. Windows, Macintosh, etc.) also. GUI applications stemming from OpenGL, a programming language used across many computer platforms, are utilized in this transfer of technology. The World Wide Web has been used to provide the scientific community with direct access to a series of GUIs designed by the student and the mentor. Also, improvements in DUCTSIZER 1.0, an interactive GUI software, have led to its definitive version. DUCTSIZER 1.0 was designed and presented by the intern last summer.

NASA/OAI Collaborative Aerospace Internship and Fellowship Program

“The Implications of Title V of the Clean Air Act to NASA Lewis Research Center”

Kerri Kahlenberg

Bowling Green State University

Senior

Environmental Health

Arthur Gedeon

ABSTRACT

Title V of the Clean Air Act of 1990 established a Federally-mandated operating permit program, which is managed by the Ohio Environmental Protection Agency (OEPA), for major sources of air pollution. The OEPA program requires NASA Lewis Research Center to comply with the Clean Air Act Amendments (CAAA) by obtaining Title V air permits as they are needed for the facility. NASA Lewis, which is a “major” air pollution source, will be submitting the permit application to the Ohio Environmental Protection Agency through a program called STARship. STARship is a remote data entry module developed by the OEPA to assist the regulated community in preparing and submitting electronic forms to the Division of Air Pollution Control (DAPC). I will be discussing the importance of Title V of the CAA, the implications of Title V regulations to LeRC, and the use of STARship to fulfill the regulatory requirements of Title V.

Wigberto Narvaez
Penn State University
Mechanical Engineering
Undergraduate
Mentor: Miguel A. Polanco

Space Station Fluids and Combustion Facility

The Fluids and Combustion facility of the International Space Station Alpha will host 3 modules for the studies of the behavior of fluids in a gravity-free environment, this modules are: The Fluids Module, the Combustion Module, and the Core Rack. The Core is the one responsible for providing all services to the whole facility: Power, Thermal Control, and Command and Data Managing. CDMS(Command and data Managing System) includes data acquisition, processing, storage, distribution and retrieval. Packaging of the internal components of the Core Rack is critical because of volume and weight constraints. So far it has been successfully design and tested the card packaging cages along with the drawers that will house them. The packaging and function of these components are going to be described.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP PROGRAM

TRACKER: A Digitized Image Object Tracking System

Robert S. Sielken
Trinity University
Computer Science and Mathematics
Undergraduate, Senior
Mentor: Robert B. Klimek

ABSTRACT

Tracker is the program which runs a system of devices designed to automatically or semi-automatically track objects from film, video tape, or laser disk. The system was originally designed to meet the needs of NASA Lewis Research Center's microgravity combustion and fluid science experiments. The program runs in Windows95 with the use of a frame grabber and a smart serial port to control the peripheral devices. Peripherals include a laser disk, SVHS tape deck, Hi - 8 tape deck, and two film transports. The Tracker program is mainly designed to perform tracking of objects from the image input. Normal tracking consists of grabbing a frame from the input source, performing some image processing on the user selected sub-region, locating the edge of the object being tracked in the sub-region, and storing the data in a file. The program can handle up to twenty sub-regions and tracking points at a time. Typical uses of the system include measuring the rate of flame spread across a combustible material and measuring droplet size as a function of time using multiple point analysis. The program also includes many image processing functions to alter images and improve tracking. New features include number recognition using neural network and digit segments schemes, line following routines, and a more user-friendly program through cleaner and more efficient code.

Research Symposium Session I
Schedule and Abstracts
Thursday, July 18, 1996
Room 225

9:15 Jesse Ingram, "Finite Element Analysis of Composite Materials"

9:30 Nigel Richardson, "Finite Element Technique in Modeling Composite Materials"

9:45 Jerome McQueen, "Solutions on How to Reduce Environmental Pollution from Engine Test Cells"

10:00 Phillip Ezolt, "The Effects of Errors on MPEG-II Video when Sent over an ATM Network"

BREAK

10:30 John Funk, "1g Wire Insulation Flammability Test"

10:45 Dwain Johnson, "Safety and Mission Assurance Concerning the Droplet Combustion Experiment (DCE)"

11:00 Thomas McGuire, Schlieren Visualization of an Optically Accessible Rocket Chamber"

11:15 Bradley Shogrin, no abstract submitted

LUNCH (on your own)

1:15 Jeffrey Williams, "The Scale Model Icing Research Tunnel."

1:30 Quiana Smith, "Web Page Creation for E-mail"

1:45 Alicia Boozer, "Predicting Solar Cell Performance Using The Environmental Work Bench"

2:00 Vashon Roland, "A Complete Lesson in Mission Safety and Assurance"

2:15 Malissa Ackerman, "Fiber Supported Combustion of N-Heptane Droplets in Microgravity"

2:30 David Arenas, "The Effect of Alloying on Sigma and P Phases in Rne N6 Nickel -Base Superalloys"

BREAK

3:00 Laura Zeller, "Determination of Surface Energy Change Evaporation of Content in Vapor Diffusion Type Protein Crystal Growth Experiment"

3:15 Dawn Heineman, "Turbidity of a Critical Fluid in the Presence of Strong Pressure Fluctuations"

3:30 Brian Maclachlan, "Thermal Radiation Analysis of Solar Dynamic Radiator for ISS"

3:45 Kristi Piasecki, "Finite Element Analysis of a Spreader Bar"

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP PROGRAM

Finite Element Analysis of Composite Materials

Jesse Ingram
Florida A+M University
Mechanical Engineering
Ph.D
Mentor: Jerry Lang

During my ten week tenure within the Engineering Directorate my job assignment was to support my mentor with his daily duties as fracture control coordinator for the International Space Station Fluid and Combustion Facility (ISS FCF). In order to provide support I became familiar with commercial tools such as p3/Patran and MSC/NASTRAN. Familiarization of I-DEAS Master Series 2.0 may also be realized but was not needed for support. My assignment was divided into three phases. Phase I was to become familiar with the above analysis codes. Phase II was to duplicate results previously conducted in the evaluation of a quasi-isotropic lay up of a continuous fiber coupon. Phase III was to evaluate and predict structural behavior of a plain weave composite component within the Fluid and Combustion Facility, and to interpret and report the results.

In my presentation a definition of finite element analysis is introduced. A procedure for using two commercial finite element analysis tools, P3/PATRAN and MSC/NASTRAN, to evaluate a quasi-isotropic continuous fiber coupon is presented. It is shown that the stress and strain distributions from the numerical analysis correlate with experimental results done at N.C. A&T University, suggesting that numerical analysis tools can predict with some degree of accuracy, real system behavior. It is shown, based on this assumption, that a complex structure, such as a plain weave composite I-beam can be modeled and results that make physical sense can be obtained.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM

Finite Element Technique in Modelling Composite Materials

Nigel Richardson
Florida A+M University
Structural Engineering
Masters Student
Mentor: Jerry Lang

My responsibility in the structural analysis branch at NASA during the summer of 1996 was to support the existing engineering staff with their daily duties. A major portion of this assignment was to assist the fracture control coordinator with determining the structural integrity of components for the International Space Station Fluid and Combustion Facility. The overall assignment was structured around three phases administered and supervised by mentor, Mr. Jerry Lang.

During the first phase, familiarization with the existing analytical tools p3/Patran and MSC/NATRAN was required. Completion of this phase was recognized when comparative results were returned from a numerical model previously completed on ANSYS 5.0. The second stage entailed modelling and analyzing a primary structural component extracted from the Fluid and Combustion Facility. The primary focus in this exercise was that of demonstration; also to reflect an understanding in the simple principles and behavior of composite materials. In addition, it was hoped through this exercise that reasonable strain results could be returned for an overall conclusion of the component structural capability.

Finally, stage three will be interpretation and communication of these results to the necessary authorities.

NASA/OAI Collaborative Aerospace Internship and Fellowship Program

“Solutions to Reduce Environmental Pollution from Jet Engine Test Cells in Engine Research
Building and Engine Components Research Lab”

Jerome D. McQueen

Florida Agricultural & Mechanical University

Masters Graduate

Environmental Engineering

Ransook Evanina

ABSTRACT

Located in Engine Research Building (23) and Engine Components Research Labs (102) are jet engine test cells whereby combustion air reacts with fuel to create jet propulsion. The result of these reactions is air pollution in the form of particulate matter and gases. Because of its high temperature, the air must pass through a spray cooling chamber where it is cooled by spraying cooling tower water into the air stream before it is released to the atmosphere. The air emissions from these test cells have been reported to cause both indoor and ambient air quality problems. The cooling tower water that is collected from the spray cooling chambers captures unburned fuel as well as particulate matter. These pollutants cause air emission problems from the cooling towers. By treating the pollution at the source or soon thereafter, the effects on the environment will be minimized or ultimately eliminated. During the presentation, an environmental systems design will be discussed that will reduce this pollution and eliminate the problems and effects associated with these tests.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM

The Effects of Errors on MPEG-II Video When Sent Over an ATM network.

Phillip G. Ezolt
Carnegie Mellon University
Electrical/Computer Engineering
Undergraduate, Junior
Mentor: Dr. Daniel R. Glover

ABSTRACT

When MPEG-II digital video is sent over a high speed ATM network, errors are bound to occur. Until now, the effects and the extent of these errors were relatively unknown. This summer a suite of utilities were written to test and determine the effects of these errors. The suite includes programs to drop individual cells of an ATM stream and individual packets of MPEG-II transport stream, a program to analyze the effect of the dropped data on the final MPEG-II video stream, and script to run extensive tests unmanned on a UNIX Sparc station. For human, rather than computational, analysis of an MPEG-II transport stream, another program was written with a graphical user interface that displays the values of various header fields in a single MPEG-II transport stream packet.

Since both ATM and MPEG-II are very new and relatively untried technologies, the test results will be used to make improvements in both the standards and the interplay between them, before either protocol becomes mainstream. The lecture will consist of a brief overview of MPEG-II digital video and ATM networking, along with a description of the test results and a discussion their significance.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM

1g Wire Insulation Flammability Test

John Funk

Purdue University

Aeronautical & Astronautical Engineering

Senior

Mentor: Kurt Sacksteder

Fire safety is a key issue in spacecraft design. One source of combustible material is the insulation of electrical components, which can reach ignition temperatures through resistive heating. The purpose of this experiment was to examine the combustion of a representative insulation material (polyethylene) in normal gravity buoyant airflows for comparison with the results of the tests conducted aboard the space shuttle during STS-50. Wire insulation samples were burned in oxygen concentrations from 15 to 21 percent, with the test samples orientated to obtain flame spreading in concurrent flow (upward), and opposed flow (downward). Data obtained from the normal gravity tests included flame spread rates using video imaging, thermocouple temperature profiles, and combustion product gas samples collected during selected tests for future analysis. Preliminary flame spread results will be presented, including a comparison between normal gravity, and microgravity flames.

NASA/OAI Collaborative Aerospace Internship And Fellowship Program

Safety and Mission Assurance Concerning the Droplet Combustion Experiment (DCE)

**Dwain Johnson
Oakwood College
Applied Mathematics
Undergraduate, Junior
Mentor: James E. Williams (OS&MA)**

-Abstract-

The experimental objectives of the Droplet Combustion Experiment is to provide a test environment suitable to accommodate microgravity research for droplet combustion so as to study droplet burning rates and extinction times. The data obtained from these tests will be utilized to:

1. Test the theoretical predictions of the liquid-phase and gas-phase steady and unsteady phenomena in the spherically symmetrical burning of pure fuel droplet.
2. Test the theoretical predictions of extinction phenomena in the spherically symmetrically burning of a pure fuel droplet by extending the range of effective characteristic times over which chemical-kinetic influences can be determined.

The DCE Project Manager is responsible for ensuring that all DCE Space Flight hardware and software meets the Product Assurance Requirements (PARs). The Office of Safety and Mission Assurance (OS&MA), will assist the DCE Project Manager in this effort by developing and controlling the Product Assurance Instructions (PAIs) needed to implement the PARs. Specific aspects of this process including material verification requirements and the actual verification process will be discussed.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM

Schlieren Visualization of an Optically Accessible Rocket Chamber

Thomas J. McGuire
Pennsylvania State University
Aerospace Engineering Major
Undergraduate, sophomore
Mentor: Dr. Stephen J. Schneider

ABSTRACT

A schlieren system has been used to visualize the flowfield of an optically accessible twenty-five pound rocket chamber for the purpose of augmenting studies being used to influence the development of numeric models of small rocket flowfields. The breakdown of the hydrogen film cooling, interaction of the film cooling and core flow, and instabilities within the combustion chamber can be observed with this technique. The facilities and experimental apparatus are described along with a discussion and display of results.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP
AND FELLOWSHIP PROGRAM

THE SCALE MODEL ICING RESEARCH TUNNEL

Jeffrey B. Williams
Brigham Young University
Mechanical Engineering
Undergraduate, Senior
Mentor: Thomas B. Irvine

ABSTRACT

A one-tenth scale model of the NASA Lewis Research Center's Icing Research Tunnel (IRT) was built for the purpose of testing proposed changes in the full-size tunnel. The Scale Model Icing Research Tunnel (SMIRT) is now in the process of being tested to compare its aerodynamics with the IRT. After the model has been validated as accurately representing the aerodynamics of the full-scale IRT, various changes will be introduced in the heat exchanger design. These changes will model potential new heat exchangers for the IRT and will give an indication of the aerodynamic characteristics of each design. Testing proposed design changes in the scale model will significantly reduce the cost and risk of evaluating, testing, and installing a new heat exchanger in the full-scale IRT. An overview of the Scale Model IRT program will be given, and the goals and results obtained thus far will be presented.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM

CREATING WEB PAGES FOR NASA EMAIL

Quiana S. Smith
Spelman College
Mathematics
Undergraduate Level
Mentor: Mrs. Mary Ann Bents

In the 1960s, the United States Military wished to improve computer communications. As a result, the United States Department of Defense sponsored the creation of the Internet. The Internet has become one of the most prominent elements of computer technology.

The Internet allows you to do many things, from sending and receiving mail to navigating the World Wide Web. HTML, which stands for HyperText Markup Language, is used to create documents for the World Wide Web, and it helps determine what is displayed when you are browsing Web documents.

HTML documents are composed of text and markup tags. These tags are used to modify the appearance of the text or to include images and/or sounds as a part of the document. Uniform Resource Locators, or URLs, are also a major part of all HTML documents. URLs are used to link to other documents and designate the location of files on other servers.

The process of creating Web pages that provide "surfers" with information about the NASA email systems will be described, in addition to the project's up-to-date results.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP PROGRAM

PREDICTING SOLAR CELL PERFORMANCE USING THE ENVIRONMENTAL WORK BENCH

Alicia D. Boozer
Spelman College
Mathematics and Electrical Engineering
Sophomore
Mentor: Dr. Sheila G. Bailey

It is becoming easier to predict the efficiency and radiation damage of various solar cells by using the Environmental Work Bench (EWB). EWB is a desktop tool used to study how a spacecraft interacts with its environment. EWB was developed by the Space Environmental Effects Branch of the Power Technology Division at NASA Lewis Research Center. Before any data can be obtained about the effects an environment has on a spacecraft, a spacecraft's geometry must first be defined and orbital parameters must be entered. EWB is built atop MIRIAD (Module Integrator and Rule-based Intelligent Analytic Database) architecture. MIRIAD allows a user to input data once and the information is transferred to other modules throughout EWB. This eliminates entering data by hand from one module to the next. Information about EWB is also available on the World Wide Web.

EWB can be used by managers, engineers, and designers to answer "what if?" type questions. Solar cell performance in space has been of particular interest to engineers developing the Space Station. Radiation belts that naturally occur in space can greatly affect the life of a spacecraft. Radiation in space frequently consists of protons and electrons. How these particles might affect a spacecraft can be examined using EWB. In this manner, EWB becomes very helpful in predicting the efficiency and the rate of degradation of a solar cell even before a mission takes place.

NASA/OAI COLLABORATIVE AEROSPACE INTERSHIP AND FELLOWSHIP PROGRAM

FIBER SUPPORTED N-HEPTANE DROPLET COMBUSTION IN LOW GRAVITY

Malissa Ackerman

Case Western Reserve University

Aerospace Engineering

Undergraduate, Senior

Mentor: Dr. Vedha Nayagam

ABSTRACT

Droplets of n-heptane were burned in low gravity aboard a DC-9 aircraft to study the effects of slow forced convection on burning rates. The droplets, ranging in size from 2-3.5 mm, were held in place by a 150 micron silicon carbide fiber and ignited in air using hot wire ignitors. PC-based image analysis routines were used to measure the diameter of the droplet as a function of time. During some experimental runs, vapor bubbles formed inside the droplet by nucleation at the fiber support. The "d-squared law" was used to calculate burning rates before and after bubble formation and over the entire combustion period. The data fit a model relating burning rate, k , to the square root of the Reynolds number, Re^1 :

$$k/k_o - 1 = \text{const. } Re^{1/2}$$

Where Re is defined as $Re = uD_o/\nu$, u is the imposed velocity, D_o the initial droplet diameter, and ν the kinematic viscosity evaluated at the mean temperature (the average between the flame and initial droplet temperatures). A second model, the Faeth correlation, was applied, but did not fit the data as closely (Pr is the Prandtl number at the mean temperature)²:

$$k/k_o - 1 = \frac{1.278 Re^{1/2} Pr^{1/3}}{(1 + 1.237 Re^{-1} Pr^{-4/3})^{1/2}}$$

No model existed to predict k for droplets with bubbles. The constant for the $Re^{1/2}$ correlation was found to be approximately .23 for the range $.69 < Re < 5.6$. Additionally, the overall burning rates for droplets with bubbles were higher than the rates without bubbles.

- [1] Law, C.K. and Williams, F.A. *Combust. Flame* 19. pp393-405 (1972).
- [2] Faeth, G.M.. *Progress in Energy and Combust. Sci.* 3. pp191-224 (1977).

**THE EFFECT OF ALLOYING ON SIGMA AND P PHASES IN
RENE N6 NICKEL-BASE SUPERALLOYS**

**David R. Arenas
Penn State University
Graduate, 2nd year
Mentor: Frank Ritzert**

An investigation was conducted to determine the compositional limit of P phases in Rene N6 nickel-base superalloys. Topologically close packed (TCP) P phase is detrimental to overall high temperature performance of nickel-base superalloys because of its brittle nature and its depletion of the nickel-rich matrix of potent solid-solution strengthening elements. Thirty-three variations of Rene N6 were cast and heat treated for 80 hours at 2400 F followed by 400 hours at 2000 F. The alloys had the following composition ranges: Co 10 to 15 weight %, Mo 0.5 to 2%, W 5.5 to 7%, Re 5.5 to 6%, Ta 7 to 8.5%, Al 5.5 to 6.25% and Cr 3 to 5%. Metallographic analysis of specimens using electron and light microscopy, phase extraction, x-ray diffraction, quantitative EDS, and microprobe gives the crystallographic, chemical and metallographic characteristics of all phases that form. The results of this investigation will be used to construct a mathematical model of the sigma and P regions of the Rene N6 system.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP PROGRAM

Turbidity of a Critical Fluid in the Presence of Strong Pressure Fluctuations

Dawn L. Heineman
James Madison University
Integrated Science and Technology
Undergraduate, Junior
Mentor: Dr. Greg Zimmerli

ABSTRACT

There exists a critical temperature, T_c , and pressure, P_c , at which the liquid and vapor phases of a pure fluid become indistinguishable. As the fluid approaches the critical temperature from above, the turbidity of the fluid increases due to density fluctuations of increasing amplitude. The turbidity is measured from the transmitted intensity of a laser beam passing through the fluid. As a precursor to measuring non-linear effects near the critical point, we have measured the turbidity of SF_6 (sulfur hexafluoride: $T_c = 318.69 \text{ K}$, $P_c = 3.76 \text{ MPa}$) in response to pressure oscillations as a function of amplitude, frequency, and distance from the critical point, $T - T_c$. The pressure oscillations were generated using a piezoelectric transducer imbedded within the fluid. The SF_6 sample cell is inside a thermostat which is temperature controlled to within 0.1 mK . The data acquisition and control is run from a LabVIEW application.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP & FELLOWSHIP PROGRAM
THERMAL RADIATION ANALYSIS OF SOLAR DYNAMIC RADIATOR FOR ISS

Brian J. MacLachlan
The University of Michigan
Aerospace and Mechanical Engineering
Senior
Mentor: Mr. Eric Golliher

ABSTRACT

The proposed Auxiliary Solar Dynamic Power System (SD) is currently being evaluated at candidate locations for placement on the International Space Station (ISS). Its primary purpose is converting solar energy to electrical power in low Earth orbit (LEO). The environmental sink temperatures of the SD radiator panels are important factors in determining the electrical power generation capacity, and therefore the overall performance capability of the SD module. Of the possible locations examined, the best thermal locations of the SD unit were at the end of the starboard S6 truss, and on top of the centrifuge. Modeling assumptions are discussed, as well as thermal analysis methods employed in the comparison and evaluation of various SD configurations and ISS placement location combinations.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP PROGRAM

FINITE ELEMENT ANALYSIS OF A SPREADER BAR

Kristi A. Piasecki
University of Dayton
Mechanical Engineering
Undergraduate, Sophomore
Mentor: Jeff Chambers

ABSTRACT

Finite element analysis was employed to verify the integrity of a spreader bar, a device used in craning operations to evenly distribute the weight of the object being lifted. Three segments of the ASCR Sector Rig vessel, each weighing more than three tons, will be lifted using the spreader bar, thus, the structural integrity of the bar is essential. One load case, containing loads and boundary conditions, was created and analyzed for each of three vessel segments to be lifted. Far field stresses throughout the beam, peak stresses in the lugs, and overall deformations were calculated using MSC/NASTRAN. MSC/PATRAN, a pre/post processor, was used to examine the results to be sure the spreader bar will satisfy the applicable NASA safety standards. The process of modeling the spreader bar, analysis, results, and conclusions of this finite element analysis are presented.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM

Spatially and Spectrally Resolved Infrared Imaging

W. Craig Washington, Jr.
Morehouse College
Chemistry
Junior
Mentor: Dr. Karen J. Weiland

ABSTRACT

Although a large part of the emission spectra of flames lies in the infrared region, very little research has been done on this part of the spectra and almost no simultaneously spectrally and spatially resolved data has been collected. A cryogenically cooled, infrared camera, making use of a 2d, InSb array, has been developed to collect this data. This camera features a direct digital output and, using a Pentium computer, has a data collection rate of 128 frames in ~1.2 seconds. In this way, spatially resolved data for 128 wavelength regions is collected simultaneously. Collection of sample flame spectra and calibration of the camera, including calibration of the focal point, pixel to millimeter ratio, integration time linearity, and spectral response, are described.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP PROGRAM

Preparing to Prove a Process for In Situ Propellant Production

Derek Atkinson
Morehouse College
Chemical Engineering Major
Undergraduate, Sophomore
Mentor: Henry Speer

ABSTRACT

In 1969 Americans were the first to set foot on the moon. Today, technology has advanced to the extent that it is possible to send astronauts beyond the moon, to Mars. Unfortunately, a round trip of this magnitude, would require an extremely large amount of oxygen and propellant. One possible solution to this problem is to use the Martian atmosphere to produce oxygen, and possible a hydrocarbon propellant, for the return trip to Earth. This would drastically decrease the mission payload, launch requirements, and cost of the mission. A special solar powered, cryogenic cooler/dewar has been designed to liquify and store gases. However, the cooler's ability to produce and store liquid, is unknown. The cooler must produce enough gas during Mars' eight hours of sunlight, and retain the liquid during Mars' sixteen hours of darkness. In order to prove that In Situ Propellant Production is feasible, the dewar needs to be tested in a simulation Mars environment. The Mars In Situ Propellant Production project will be discussed in greater detail, as well as the design of the test that will take place on the dewar.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP PROGRAM

"Sight" for a Smart Wheelchair

Kenneth Dalton Pangburn III
Morehouse College
Mechanical Engineering
Undergraduate, Junior
Mentor: Gail Perusek

The ARGUS wheelchair project is being developed through the Case Engineering Service Group with the Cleveland Clinic Foundation and the NASA Lewis Research Center. Most of the people involved are either graduate students at Case or summer interns at Lewis Research Center. The goal of the Argus Project is to modify an existing power wheelchair with several "Smart" features such as object avoidance and voice feedback. This new "Smart Wheelchair" will be used to teach severely disabled children to operate a regular power wheelchair, thus achieving independent mobility. The "Smart" features serve to protect the patient from injury and facilitate learning during sessions. Here at Lewis Research Center we are in charge of giving sight to this wheelchair. This will be done by attaching ultrasonic sensors and this will achieve object avoidance.

Research Symposium Session I
Schedule and Abstracts
Friday, July 19, 1996
Room 225

9:15 Than Thein, "Non-invasive Measurement of the Surface Tension and Viscosity of the Liquid/Vapor Interfaces Through Surface Light Scattering Techniques"

9:30 Rich Vavrek, "Pointing and Control System Analysis for Replanned Solar Dynamic Power Project"

9:45 Robert Adamson, "New System to Further Enhance Dewpoint Control in the 10x10 SWT"

10:00 Todd Bocksell, "Numerical Simulation and Prediction of Liquid Water Content in the Icing Research Tunnel at NASA Lewis Research Center"

BREAK

10:30 Melanie Demo, "Performance of Multilayer Filters Using Gold and High Temperature Superconductors on Dielectric Thin Films"

10:45 Michele Comiskey, "Composite Micro-Mechanical Results Processing Utilizing Patran Command Language"

11:00 Adam Krigel, "Problem Solving Dealing with High-Sensitivity Phase-Shifting Interferometry in Liquid-Vapor Critical Fluid Experiment"

11:15 Agnes Poslowski, "Evaluation of Several Space Lubricants Using the Four-Ball Tribometer"

LUNCH (on your own)

1:15 Chimezie Thomas-Ogbuji, "V.I.S.I.T."

1:30 Brenda Edmonds, "The Mechanical Properties of Blood: Implications for the Innovative Ventricular Assist System Heart Pump"

1:45 Allyn Turner, no abstract submitted

2:00 Graham Kaiser, no abstract submitted

2:15 Ronnie Ortiz, "High Temperature Composite Interfacial Study"

2:30 Lance Jacobsen, "Albedo and Planetary View Factors Via Finite Difference Approach"

2:45 Amy Mielke, "Visualization of Gas Phase Recirculation Cell in Front of a Flame Spreading Across a Liquid Pool"

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP PROGRAM

Non-invasive Measurement of the Surface Tension and Viscosity of the Liquid/Vapor Interfaces Through Surface Light Scattering Techniques

Than Thein
Univ. of Michigan
Major- Biology
3rd year Undergrad
Dr. Arnon Chait/Dr. Padetha Tin

Light scattering techniques allow for a non-invasive method of determining the surface tension and viscosity of the liquid/vapor interface of a liquid. Traditional methods of determining surface tension and viscosity require probes of some sort to be lowered into the medium which cause unwanted disturbances. This non-invasive technique allows us to obtain the information without the problem of disturbing the surface of the liquid.

The light scattering method of choice is to reflect a laser light off the surface of the medium in question, and into a photo detection system. Since the fluid is at a temperature above absolute zero, it is affected by thermal changes across its surface causing the formation of naturally forming thermo-cappillary waves. The minute waves on the surface cause the laser light to scatter which is detected by the photo detector. The information is then used in the time auto correlation technique, and from that, the surface tension and viscosity can be determined by the fluid dynamic theory.

Originally, a setup to run this experiment was very space and energy consuming, but developments in technology have allowed for much more efficient setups using bulk optics, and fiber optics which is now available not only for laboratory research and development type experiments, but also for space borne experiments and industrial uses.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM

Pointing and Control System Analysis for the Replanned Solar Dynamic Power Project

Richard M. Vavrek

The University of Dayton

Electrical Engineering

Undergraduate (Junior)

Mentor: Mr. Clint Ensworth

ABSTRACT

A simplified computer model, based on block diagram control theory, has been created to aid in the analysis and design of a pointing and control system for the Replanned Solar Dynamic Power System designed for use on International Space Station Alpha. This model, created in two distinct computer mediums, incorporates assumed physical properties of the actual SD module as well as specific controllers and disturbances associated with low-earth-orbit (LEO). The model specifically targets fine pointing errors caused by space related disturbances and periodic station displacements (attitude adjustments, shuttle dockings). Factors typically affiliated with control design such as stability, error, and steady state and transient responses are described. Additional areas to be covered include possible SD configurations on Station, the future of Solar Dynamics in space, and the need for more concise information to fully optimize pointing and control system parameters.

Nasa/OAI Collaborative Aerospace Internship and Fellowship Program

New System to Further Enhance Dewpoint Control in the 10x10 SWT

Robert L. Adamson
Rensselaer Polytechnic Institute
Mechanical Engineering
Junior
Mentor: James Roeder

A rotary potentiometer has been attached to the drive axle on door two, in the Air Dryer. The potentiometer gives an indication on the position of door two, which opens to the atmosphere. Previously the door only had open/close limit switches. By opening the door partially (which is normally closed during the propulsion cycle) a bypass of the dryer beds is hoped to be created. This bypass will let moist air into the tunnel during the propulsion cycle thus raising the dewpoint. The increase dewpoint control capability is needed for the upcoming Unstart Test scheduled for January of 1997, which involves a laser sheet flow visual. Testing for the new system will be done near the beginning of the upcoming 2D Inlet Test, slated to start July 22, 1996.

NASA/OAI Collaborative Aerospace Internship and Fellowship Program

Numerical Simulation and Prediction of Liquid Water Content in the Icing Research Tunnel at NASA Lewis Research Center.

Todd L. Bocksell
University of Illinois at Urbana-Champaign
Aeronautical and Astronautical Engineering
Graduate, MS
Mentor: Thomas B. Irvine

ABSTRACT

The objective of this study is to implement and utilize a computational methodology involving NPARC and KICE for robust and accurate prediction of spray bar droplet dispersion for icing tests. The complete turbulent flow in the Icing Research Tunnel (IRT) is solved using NPARC and then KICE computes the Liquid Water Content (LWC) in the test section by tracking the water particles in a Lagrangian manner after injection. KICE is a recently developed code for tracking particles in a turbulent fluid flow by employing a stochastic eddy model to simulate turbulent dispersion as the particles travel downstream. The end result of this study is to predict an optimal nozzle distribution for LWC uniformity in the IRT test section and avoid the costly, in both time and money, trial-and-error method of determining a nozzle layout pattern.

**NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM**

**PERFORMANCE OF MULTILAYER FILTERS USING GOLD AND HIGH
TEMPERATURE SUPERCONDUCTORS ON DIELECTRIC THIN FILMS**

Melanie S. Demo
Rice University
Electrical Engineering
Undergraduate, Sophomore
Mentor: Dr. Félix A. Miranda

ABSTRACT

Since the discovery of High-Temperature-Superconductors (HTS) in 1986 the feasibility of HTS-based microwave components for satellite communications has been demonstrated. This project concentrates on multilayer structures fabricated from metal or HTS on dielectric thin films. By using HTS, the performance of the filter is expected to increase while the size remains small. Stacking layers reduces the filter volume needed in satellites, which is beneficial because less power will be needed for smaller, more efficient satellites. This presentation discusses computer modelling, fabrication, and testing of single layer gold and HTS resonators and progress made so far on the development of multilayer stacked structures.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM

COMPOSITE MICROMECHANICAL RESULTS PROCESSING UTILIZING PATRAN
COMMAND LANGUAGE

Michele D. Comiskey
Kent State University
Computer Information Systems
Undergraduate, Senior
Mentor: Robert K. Goldberg

A composite micromechanical results processor has been developed for the purpose of interpreting the results from thermomechanical deformation analyses of advanced composites. The results processor executes within the environment of the MSC/Patran graphic visualization software product. The use of such a program simplifies the process of results interpretation while enhancing the usability of the in-house Micromechanics Analysis Code (MAC). The results are analyzed from micromechanical and macromechanical points of view utilizing two distinct result applications: XY plots and contour plots. The simplification of results processing is described, as well as the interpretation of example analysis and the interactive input necessary to produce specified results.

**NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP
AND FELLOWSHIP PROGRAM**

**Problem-Solving Dealing with High Sensitivity Phase-Shifting Interferometry in
Liquid-Vapor Critical Fluid Experiment**

Adam H. Krigel
UC Berkeley
Astrophysics, Physics
Undergraduate, Junior
Mentor: Dr. Allen Wilkinson

ABSTRACT

The liquid-vapor critical temperature is the unique point at which the transition of a pure fluid from a liquid to a gaseous state becomes continuous. At this point, the critical fluid attains radical properties, such as infinite compressibility and heat capacity. Just above its critical temperature, the fluid's high compressibility in the presence of gravity lends itself to a stratified density inhomogeneity. This stratification leads to varying indices of refraction. In an effort to understand the thermodynamics behind critical phenomena, an expanded laser beam is directed through a dime-shaped sample of sulfur hexafluoride (SF_6) as the fluid is brought to within a few milli-Kelvin about its critical point. Hence, using interferometric techniques, the fringe patterns are ultimately analyzed to assess the density distributions of the critical sample as a function of time and temperature.

Problems dealing with uncontrolled interferometric phase shifting observed during computer analysis are also discussed. The temperature response of the fluid to blackbody radiation heat loss was quantified. The expected change in optical path length in the interferometer due to thermal expansion was calculated. A spatial filter with an iris diaphragm to remove a spurious bright spot in the fringe images was constructed.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM

EVALUATION OF SEVERAL SPACE LUBRICANTS USING
THE FOUR-BALL TRIBOMETER

Agnes K. Poslowski
John Carroll University
Chemistry Major
Senior

Mentor: Dr. William R. Jones, Jr.

ABSTRACT

The friction and wear behaviors of several lubricants were investigated under boundary lubrication conditions using a four-ball tribometer and 440C stainless steel specimens. Three of the lubricants tested were perfluoropolyethers (Krytox 143AC, Demnum S-200, and Fomblin Z-25), and one was a synthetic hydrocarbon (Pennzane 2001) fortified with an antiwear and an antioxidant additives. The test conditions included: a pressure $<5.0 \times 10^{-6}$ torr, a 200N load, a sliding velocity of 28.8 mm/sec (100rpm), and room temperature (23°C). The wear rate for each lubricant was determined from the slope of the wear volume as a function of sliding distance. The hydrocarbon possessed the lowest overall wear rate. Of the perfluoropolyethers (PFPEs), wear rates decreased from Fomblin Z-25 to Demnum S-200, with Krytox 143AC having the lowest wear of the three.

NASA / OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP PROGRAM

V.I.S.I.T.

Chimezie U. Thomas-Ogbuji
University of Illinois at Champaign Urbana
Computer Engineering
Undergraduate, Sophomore
Mentor: David W. York

ABSTRACT

This summer, I developed a program called Visualization of Interplanetary Trajectories (VISIT). VISIT is a software program which was developed to display the trajectories of man-made satellites and the planets of the solar system. The program runs on any workstation with an installed **OpenGL** package. It reads the positions of the planets, which were extracted from the Jet Propulsion Laboratory (JPL) program, **Ephemeris**, as well as the position-versus-time data of the man-made satellite from the output of an external N-body trajectory program. The user can track any object (planet or satellite) from a chosen frame of reference. The user can also increment the time manually as well as choose the time scale of the animation. This program was developed to benefit those users who wish to visualize complex, interplanetary trajectories.

**NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM**

**THE MECHANICAL PROPERTIES OF BLOOD:
IMPLICATIONS FOR THE INNOVATIVE VENTRICULAR ASSIST SYSTEM
HEART PUMP**

Brenda M. Edmonds
Ashland University
Pre-Med/Toxicology
Undergraduate, Sophomore
Mentor: Christopher Dellacorte

ABSTRACT

The Innovative Ventricular Assist System (IVAS) is a cardiac assist device originally developed by the Cleveland Clinic and is currently being analyzed by NASA Lewis Research Center. This left-ventricle assist device is unique in its class because it will not only pump blood through the apparatus, but use the blood as a lubricant for the bearing. The minimum space in which the blood will travel through the bearing is extremely small, 30 microns, when compared to the red blood cell that is between 8 and 15 microns in size. In order to implicate this design, it is necessary to research the mechanical and rheological properties of blood, and make a prediction of what effect the device will have on it.

The IVAS will be producing shear stresses in the order of 500 Dyne/cm², a high amount when the normal shear stress in the body is well under 100 Dyne/cm². It was discovered that the red blood cell will have minimum hemolysis in the pump due to the fact that the residence time through the bearing is relatively short. The problem that will be most relevant to the design is platelet activation. High shear stress may cause a platelet aggregate to adhere to the pump causing failure. Blood by nature is a Non-Newtonian fluid, but in this device under high shear rates, it was discovered that blood may act like a Newtonian fluid. Whether or not blood will be Newtonian has not been determined and will need further study.

HIGH TEMPERATURE COMPOSITE INTERFACIAL STUDY

Ronnie Ortiz
Ohio-State University
Biomedical Engineering
Graduate Student
Mentor: James K. Sutter

ABSTRACT

In today's modern aerospace arena, high temperature polymer composites are being investigated as replacements to heavier metal components. The polymer composites must display excellent thermal-oxidative stability as well as dependable mechanical properties. The interfacial adhesion between graphite fibers and any matrix system plays a crucial role in determining these properties. In efforts to optimize the interfacial behavior between the fibers and the matrix a statistical study has been proposed to determine which matrix system interacts best with a particular graphite fiber system. This study will compare between two different polyimide resin systems and each fiber system (n=3) has been coated with a different sizing. The sizing not only serves as a protective coating, but also acts to improve the interaction with the resin matrix. Currently 12 out of the 24 panels to be used in this study have been processed. Once the other 12 have been processed mechanical, thermal, and void volume tests will be conducted.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM

VISUALIZATION OF A GAS-PHASE RECIRCULATION CELL IN FRONT OF A FLAME
SPREADING ACROSS A LIQUID POOL

Amy F. Mielke
University of Dayton
Mechanical Engineering
Undergraduate, Junior
Mentor: Dr. Fletcher J. Miller

ABSTRACT

Visualization techniques, specifically a smoke wire and gas-phase particle seeding, are being utilized separately to obtain images of a gas-phase recirculation cell in front of a flame spreading across a flammable liquid pool. The recirculation cell is predicted from a numerical model to be present within 1 mm above the fuel surface, and should occur just in front of the spreading flame. A forced laminar air flow carries the smoke or particles toward the flame front. Various light sources were used to illuminate the smoke or particles which included white light, an infrared laser, and a visible laser. The flow patterns are revealed by the illuminated smoke or particles and the recirculation cell is captured on video. Typical cells range in size from 1-2 mm in height and 4-5 mm wide. Some of the cells visualized in the results are quite clear and agree well with the theory. One goal in this project is to determine the life cycle of the recirculation cell and its location in the flame's pulsation cycle. The experiments have only been performed using 1-butanol, which at room temperature exhibits a pulsating spread. This means the flame front pulsates or jumps throughout its spread rather than having a uniform spread. Plans for the future include performing experiments in the uniform spread regime to see if a recirculation cell will form. Tracking of the flame front from the top view has revealed the pulsation cycles and speeds of the flame spread.

Research Symposium Session I
Schedule and Abstracts
Friday, July 19, 1996
Room 215

- 9:15 Kelly Ockunzzi**, "Computer-Controlled Positioning
9:30 Lori Di Mauro, "Two-Dimensional Species Measurements in a Sector Gas Turbine Combustor Using Planar Laser-Induced Fluorescence"
9:45 Christy Smith, "Emission Gas Sample Data in a Turbine Engine Combustor Rig"
10:00 Amy Bartlett, "Integrated GUI Menu for SPACE Using OSF/Motif"

BREAK

- 10:30 Josh Davis**, "Space Mechanisms Handbook Project and Neural Network Analysis of Tribological Behavior"
10:45 Mike Doty, "A Correlation Study of Output Variables for the AE3007C Turbofan Engine"
11:00 Denis Lynch, "The Development of Analytical Expressions to Describe the Motion of a Potential Ultrasonic De-Icing System"

LUNCH (on your own)

- 1:15 Yvonne Yoder**, "Resistivity of Carbon Fiber Cyanate Ester Composites"
1:30 Wayne Keels, "Implementing a Measurement System for High Temperature Strain Gages via the use of Commercial Data Acquisition and Process Control Software"
1:45 Carol Cummiskey, "Development of Diagnostics for FCF Core Systems"
2:00 Joyce Fu, "Synthesis of Monomers for Polyimides"
2:15 Andrea Hess, "Photophysics Investigation of Excited State Charge Transfer in Substituted Tetraphenylbenzo [1,2-b;5,4-b']difurans"
2:30 Giadira Leon, "Multilayer and Tunable Microwave Components for Satellite Communications"

BREAK

- 3:00 Cherisse Stevenson**, "Non-Mutagenic Diamines for High Temperature Polyimide Resins"
3:15 W. Craig Washington, Jr., "Spatially and Spectrally Resolved Infrared Imaging"
3:30 Derek Atkinson, "Preparing to Prove a Process for In Situ Propellant Production"
3:45 Kenneth Pangburn, "'Sight" for a Smart Wheelchair"

**NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP
AND FELLOWSHIP PROGRAM**

COMPUTER-CONTROLLED POSITIONING

Kelly A. Ockunzzi
Case Western Reserve University
Computer Engineering
Graduate, Ph.D.
Mentor: Dr. Yolanda R. Hicks

ABSTRACT

The Optical Diagnostics Group of the Combustion Technology Branch performs combustor studies using laser beams and detectors. Two optically-accessible combustion rigs are available in the test cell. The laser beam is produced outside of the test cell and directed with mirrors to one of the two rigs. The detectors are mounted next to the rig. The mirrors and detectors are mounted on motorized stages to allow positioning. These stages are controlled by motion controllers. The varying characteristics of the stages and motion controllers, as well as the large number of stages required, prompted the development of one computer program to control the motion controllers and coordinate the stages' movements. The positioning program has an extensive setup procedure to allow flexibility in mounting the stages and connecting them to the motion controllers. An alignment procedure is available to position stages individually, aligning the laser beam and detectors and defining an origin within the test region. The traversal procedure positions the laser beam at specific coordinates within the test region and moves the detectors so that they remain in focus with the beam. This program facilitates the build-up before a test run as well as image acquisition during a test run.

**NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM**

**TWO-DIMENSIONAL SPECIES MEASUREMENTS IN A SECTOR GAS TURBINE
COMBUSTOR USING PLANAR LASER-INDUCED FLUORESCENCE**

Lori A. Di Mauro

Case Western Reserve University

Aerospace Engineering

Undergraduate, senior

Mentor: Dr. Yolanda R. Hicks

ABSTRACT

The design of a gas turbine combustor with reduced emissions of unburned hydrocarbons, smoke, and oxides of nitrogen (NO_x), while maintaining high operating efficiency, is in high demand. For this purpose, an improved understanding of the combustion process at typical flight operating conditions is needed. Four quartz windows allow visual access to the combustion chamber of a sector gas turbine combustor rig, which uses real jet fuel (JP-5 or Jet A). The rig was built to test combustors at simulated operating conditions. Planar laser-induced fluorescence (PLIF) is used to look at OH, an important combustion intermediate; its presence indicates where combustion is occurring and thus where heat is being released. A laser emits a 283 nm wavelength, ultraviolet laser beam, which is directed to the rig and turned into a two-dimensional light sheet by a series of lenses. It enters the rig either vertically or horizontally. A camera takes images of the excited OH molecules. The span, average, maximum, and minimum signals of the images are then determined and plotted against flame temperature. The expected signal will increase with flame temperature; however, results show a decrease at equivalence ratios between 0.5 and 0.53. Kinetics may be the reason for this trend and is a possible future research topic.

**NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM**

EMISSION GAS SAMPLE DATA IN A TURBINE ENGINE COMBUSTOR RIG

Christina F. Smith
Case Western Reserve University
Mechanical Engineering
Undergraduate, Junior
Mentor: Dr. Yolanda R. Hicks

ABSTRACT

A unique test rig that simulates supersonic flight conditions in a turbine engine combustor exists in the Engine Research Building, cell CE-5 at Lewis Research Center. In order to validate planar laser induced fluorescence images (PLIF) taken through quartz windows, gas sample probes were installed. Readings were taken from a Rosemount Analytical gas bench at various pressure and temperature conditions corresponding to take-off, cruise and landing. A lean premixed, prevaporized system was used in an effort to reduce NO_x emissions. Greater confidence in low pollutant levels was gained by performing two carbon-balance based checks on the data. Although the data was taken over a one year period with different injector configurations, there are some general trends.

NASA / OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM

INTEGRATED GUI MENU FOR SPACE USING OSF / MOTIF

Amy R. Bartlett
The University of Idaho
Computer Engineering
Undergraduate, Junior
Mentor: Jeffrey S. Hojnicky

Integrated GUI Menu for SPACE using OSF / Motif

ABSTRACT

An integrated graphical user interface (GUI) menu has been created to enhance the examination of plot-orientated results generated by the System Power Analysis for Capability Evaluation (SPACE) program. SPACE, according to Jeffrey S. Hojnicky, et al., is a computer simulation designed to predict the highest power that an electric power system could produce throughout the sunlight and eclipse portions of a specific orbit. The GUI menu developed for SPACE relies on an X Window-based OSF/Motif widget set to optimize resources available to the analyst. Significant menu resources include user selection from a descriptive list of available plots, PostScript conversion abilities, detailed screen views, and full printing capabilities. This effectual addition will greatly improve the current SPACE assessment technique, thereby increasing evaluation efficiency.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP PROGRAM

Space Mechanisms Handbook Project and Neural Network Analysis of Tribological Behavior

Joshua R. Davis
Oberlin College
Mathematics
Junior
Mentor: Robert L. Fusaro

ABSTRACT

A space mechanisms design guidelines handbook is being prepared for NASA and its industry collaborators. The handbook presents a categorical overview of space mechanism design, qualification, and application issues. Various methods were explored for making this and related documents available electronically on CD-ROM and on the World Wide Web. It was eventually decided that of document standards Portable Document Format offers the richest combination of feature set, ease of use, and portability.

In addition to the electronic documentation project, continuing research on the use of artificial neural networks (ANNs) in analyzing and predicting bearing and lubricant behavior is being performed. This research explores the feasibility of using ANNs for accelerated life testing, which becomes increasingly important as mission duration expectations grow. A paper which is intended to introduce tribologists to this technology is currently being prepared for the journal *Lubrication Engineer*.

The presentation will discuss the space mechanisms handbook and the process of publishing it electronically. It will also give a brief overview of ANN technology and its possible application to tribology.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM

A CORRELATION STUDY OF OUTPUT VARIABLES FOR THE AE3007C TURBOFAN
ENGINE

Michael J. Doty
Pennsylvania State University
Aerospace Engineering
Graduate Student
Mentor: Dr. Ten-Huei Guo

ABSTRACT

Neural network technology will be implemented in the controller of the Allison 3007C turbopfan engine to improve engine control reliability. In order to design the neural network, a redundant group of output sensors was found using TERMAP (Turbine Engine Reverse Modeling Aid Program). A group of four redundant sensors was selected after the output values given by TERMAP were normalized and compared in a correlation study. The engine is described briefly, and the essential parameters for study are discussed. In addition, the steps involved in the correlation study, as well as the selected sensors, are presented.

**NASA/OAI Collaborative Aerospace Internship
and Fellowship Program**

**The Development of Analytical Expressions to Describe
the Motion of a Potential Ultrasonic De-Icing System**

Denis A. Lynch III
University of Notre Dame
Graduate Student, Aerospace Engineering
Mentor: Mr. Damian R. Ludwiczak

ABSTRACT

As the development of an ultrasonic system with deicing capabilities continues, it is important to better understand the process by which the system performs this function. Since the motion of the system is credited with breaking the bond between the ice and aluminum, component motion parameters such as displacement, stress, and strain are crucial to the prediction of system effectiveness and efficiency. Therefore, analytical expressions are derived and presented to describe the motion of each of the components of the system. These results are then compared with experimental results, demonstrating the overall reliability of the analytical predictions.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP PROGRAM

Resistivity of Carbon Fiber Cyanate Ester Composites

Yvonne R. Yoder
Manchester College
Chemistry
Senior
Dr. James R. Gaier

Intercalated graphite fiber composites have been studied for use as an electromagnetic interference (EMI) shielding material. The EMI shielding effectiveness depends on the resistivity of the shielding material; however, the resistivity of the composites has been hard to determine. The definition of resistivity assumes homogeneity of the sample being measured. Composite resistivities depend on the method of analysis and the direction of the fibers in the matrix. Two methods, a four point voltage analysis and a contactless conductivity probe which utilizes eddy currents, were used to study the electrical characteristics of both pristine and bromine intercalated fibers set in RS-3 resin from YLA, Inc (Benicia, California) which were cut at 0, 15, 30, and 45 degrees relative to the fiber direction. These values will be compared and correlated to EMI shielding effectiveness data. Further work is also under way to decrease the resistivity of the composites by increasing the conductivity of the resin using a highly conductive polymer. RS-3 impregnated intercalated fiber mats will be doped with 3-methylthiophene (3MT) and oxidatively polymerized before pressing and curing the composites. The same methods of electrical analysis of the composites will then be repeated on the doped composites.

Implementing a Measurement System for High Temperature Strain Gages:
Via the use of commercial data acquisition & process control software

Wayne A. Keels
Purdue University
Computer Science, Masters
Dr. Herbert Will

ABSTRACT

Data acquisition is a diverse area, covering many different applications and requirements. The general concept involves measuring some type of electrical signal. A typical signal would be an analog value from some form of sensor; things like temperature, pressure, voltage, etc. The signal is converted into digital form and the value is passed on to a computer hardware and/or software to act upon it. Through the development of powerful data acquisition (Daq) & process control tools, clients are now able to successfully integrate selected hardware devices with comprehensive software, generating reliable measurement systems.

The strain gage testing facility at NASA Lewis Research Center utilized two of the market's leading commercial Daq & process control software in the design of two measurement systems: the first on a Power Macintosh platform (Labview 4.0 for macs), and the second on a 386 IBM PC platform (Labtech for PC's). Both systems were successfully implemented using the two independent software and key observations were made that resulted in one (software) being highly favorable over the other. This paper is not intended to disclaim any current vendors of Daq & process control software, but to simply convey information to any persons who are currently involved in or simply possessing an interest in the field of measurement system programming. In addition, a brief discussion of the two measurement systems (i.e., GPIB and serial instrument control, data analysis, data presentation, and data storage), that were developed within the strain gage testing facility, will be presented.

DEVELOPMENT OF DIAGNOSTICS FOR FCF CORE SYSTEMS

Carol A. Cummiskey
COLLEGE OF NEW JERSEY
ELECTRICAL ENGINEERING
UNDERGRADUATE, SENIOR
MENTOR: Dennis Culley

ABSTRACT

A series of diagnostic test set-ups (hardware and software) have been developed in order to verify operation of the hardware that will comprise the Fluids Combustion Facility (FCF) Core systems. The Core systems of the Fluids Combustion Facility are designed to give long term support to an array of microgravity experiments on board the International Space Station. In which case, a self-diagnostic system is desirable to insure that no hardware malfunctions will affect the system and to minimize repair time for the crew. The test set-ups developed will provide a relatively low level understanding of how the systems operate which will aid in the design process of a Built-In Diagnostics for the FCF Core System. An individual test set-up for a GreenSpring IP-Thermistor and its significance in developing a Built-In Test will be described.

NASA/OAI Collaborative Aerospace Internship and Fellowship Program
Synthesis of Monomers for Polyimides

Joyce Fu
Harvard/Radcliffe College
Biochemistry
Sophomore
Mentor: Dr. Kathy Chuang

In synthesizing new monomer reactants for polymers, one of the goals has been to find a non-mutagenic replacement for MDA, the mutagenic diamine monomer used in PMR-15, a high-temperature polyimide currently being used in industry. The small aromatic ring of MDA makes it an intercalating agent, meaning it can easily slip between the base pairs of DNA, causing mutations and cancer. A larger diamine with more aromatic rings is bulkier, and therefore less likely to intercalate into DNA. The synthesis of one particular multi-ring phenoxydiamine has been initiated. This specific phenoxydiamine is similar to another diamine, BAPP, already known to be non-mutagenic. A second goal is to reduce the cost of composite manufacturing by using resin transfer molding (RTM) as opposed to the hand lay-up used for PMR-15. Like BAPP, this phenoxydiamine is proposed to be well-suited to RTM. But by changing the linking group of BAPP, the polyimide made from this phenoxydiamine is expected to have a higher T_g (glass transition temperature) than the BAPP-based polyimide. Efforts have been devoted to improve the synthetic yield of this monomeric diamine.

Photophysics Investigation of Excited State Charge Transfer in Substituted Tetraphenylbenzo[1,2-b;5,4-b']difurans

Andrea M. Hess
Wright State University Medical School

Mentor: Judith V. Auping
Polymers Branch, Materials Division
and
Michael A. Meador
Polymers Branch, Materials Division

Abstract

Fluorescence emission spectra are being gathered in order to investigate excited state charge transfer in substituted tetraphenylbenzo[1,2-b;5,4-b']difurans. In these benzo-difuran systems, charge transfer follows the Twisted Intramolecular Charge Transfer (TICT) first proposed by Grabowski. In most TICT systems, two excited states are observed: a non-polar locally excited state (LE) and a polar charge transfer state (CT). However, the tetraphenylbenzo[1,2-b;5,4-b']difurans possess a non-planar ground state geometry that favors the LE to TICT conversion to the extent that there is no observed emission from the LE state. Fluorescence lifetimes are being measured using standard Stern Volmer quenching and fluorescence quantum yields are being determined in order to examine the effects of solvent polarity on the TICT system. These substituted benzo-difuran molecules are possible candidates for use as fluorescent probes in polymers or biological systems.

Multilayer and Tunable Microwave Components for Satellite Communications

Giadira V. León

Rensselaer Polytechnic Institute

Electrical Engineering

Undergraduate, Senior

Mentor: Félix Miranda

As satellite communication systems become more complex, they will require more filters and more sophisticated components to provide quality service. Therefore, a great interest to enhance savings in volume and weight of such compounds without affecting their functionality arises. Here we present two approaches that are in progress at the Electron Beam Technology Branch to achieve size minimization with quality enhancement. First we discuss work on miniaturized filters made of (metal, High Temperature Superconductor [HTS])/dielectric multilayer structures intended to operate at 4.0 GHz. Then we will present information regarding the progress of tunable metal/ferroelectric transmission lines for the development of a tunable local oscillator. Results on the modeling, fabrication and testing of these structures are conferred.

**NASA/OAI Collaborative Aerospace Internship and Fellowship Program
Non-Mutagenic Diamines for High Temperature Polyimide Resins**

Cherisse M. Stevenson
Spelman College
Dual Degree Chemistry/Chemical Engineering
Junior
Mentor: Dr. Peter Delvigs

The Polymers Branch of the Materials Science Division at NASA Lewis Research Center, headed by Dr. Michael Meador, continues in ongoing efforts to find a non-mutagenic substitute for 4,4'-methylene dianiline (MDA), one of the monomeric reactants of NASA's PMR-15. It is believed that the substitution of bulky groups to form sterically hindered aryl diamines will inhibit the compound's ability to take on the DNA invading planar conformation, thereby reducing its intercalating properties. Four diamines substituted with trifluoromethyl groups were prepared by Dr. David Klopotek of St. Norbert College. Following the determination of their non-mutagenic properties by the Ames Test, molding powders were then prepared from these diamines, 6FDE, and phthalic ester as the endcap. The unimidized molding powders were then staged in air circulating ovens in preparation for molding and later subjected to various thermal analyses. A hydraulic press with electrically heated platens was used for control of temperature and pressure during cure to form a neat resin disk. The thermal properties of these disks were then determined.

Research Symposium II

Student Abstracts

**NASA/OAI Collaborative Aerospace Internship and Fellowship Program
Research Symposium Session II
August 8-9, 1996**

**Thursday, August 8, 1996
ADMINISTRATION BUILDING (3), ROOM 215**

- 9:15am Bradley Mendelson, "Methane Laminar Gas Jet Diffusion Flame Shapes in Microgravity"**
- 9:30am Peter Kascak, "Redesigning the EPS (Electric Power Systems) Testbed Facility"**
- 9:45am Tanesha Brown, "Development and Analysis of Requirements and Standards for NASA-wide Interoperability"**
- 10:00am Carin Lundquist, "Low Gravity Smoke Particle and Light Detection"**

BREAK

- 10:30am Michael Lienhard, "Investigation of Low Molecular Weight Carbosilanes as Low Temperature Single Source Precursors for Chemical Vapor Deposition of Single Crystal Silicon Carbide"**
- 10:45am Andrei Gnepp, "Analysis and Processing of Images from the DARTfire Project"**
- 11:00am Thomas Kudla, "Local Area Network Support"**
- 11:15am Julie Kleinhenz, "1g Ignition and Flame Spread Over a Thermally Thick Sample in Opposed Flow"**
- 11:30am Gail Jefferson, "ISS Fluids and Combustion Facility Flow Test Support"**

ADJOURN

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM

Methane Laminar Gas Jet Diffusion Flame Shapes In Microgravity

Bradley J. Mendelson
Princeton University
Mechanical Engineering
Undergraduate, Junior
Dr. Peter B. Sunderland and Dr. David L. Urban

The shapes of methane laminar gas jet diffusion flames have been studied in a microgravity environment. This investigation focused primarily on blue flames (no soot) that had reached steady state. Tests were conducted in the NASA Lewis Research Center 2.2 second Drop Tower with ignition occurring in microgravity. The controlled parameters were nozzle diameter, fuel flow rate, and ambient pressure. Imaging of the flames was accomplished by use of a CCD video camera that simultaneously obtained and relayed signals through a fiber optic cable. It was found that the ratio of flame length to nozzle diameter was linearly related to the fuel Reynolds number. This relationship was independent of chamber ambient pressure and correlated with existing theory. The results of this experiment are intended to help improve the existing techniques used in the computer modeling of laminar gas jet diffusion flames.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP PROGRAM

Redesigning the EPS (Electric Power Systems) Testbed Facility

Peter E. Kascak
The Ohio State University
Electrical Engineering
Undergraduate, Senior
Mentor: Larry M. Trase

ABSTRACT

The EPS (Electric Power Systems) Testbed facility handles a variety of power system development projects directly providing support to the Space Station program, the microgravity FCF (Fluids Combustion Facility), ISUS (Integrated Solar Upper Stage) project, solar dynamic, flywheel energy storage, and small spacecraft power systems.

The EPS Testbed is presently being redesigned to better support a variety of testing. Lonworks Neurons (microcontrollers) are being added to all of the facility's testing modules. All of these Neurons will network back to the Lab's computers. This should better automate testing and data acquisition.

Currently I am involved in the project in a number of different ways. For example in the development an IEEE 488 interface algorithm for the Neurons. Also the development of calibration procedures for the testing modules. Also in the design of circuit boards for quick data acquisition using the parallel and serial ports of a P.C. I am developing a database for quick reference of parts, manufacturers, vendors, and the modules that they are used in. And finally I am involved in the designing of a voice display of the testbed for the building lobby.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP PROGRAM

Research and Development of Standards and Requirements for NASA-wide Interoperability

Tanesha J. Brown
Spelman College
Mathematics
Undergraduate, Senior
Mentor: Rhonda Y. Arterberrie

ABSTRACT

The Information Technology (IT) Lead Centers were developed to identify and define standards and architectures that are appropriate to support the NASA IT infrastructure. Lewis Research Center was selected as the Workgroup Hardware and Software Lead Center. As such the Lead Center is responsible for Basic Interoperability, Workgroup/NASA-wide Services and Special Purpose Services. The implementation of office suite interface and product standards will allow interoperability among and between NASA Workgroups in an effective and efficient manner. The process for developing these standards is described, as well as the current status and necessary future steps.

NASA/OAI COLLABORATIVE INTERNSHIP AND FELLOWSHIP PROGRAM

Low Gravity Smoke Particle Detection

Carin B. Lundquist
Princeton University
Mechanical Engineering
Sophomore
Mentor: Dr. David L. Urban

Fires aboard spacecraft pose a serious risk to the crew and equipment. The development of fire detectors that operate effectively in a low gravity environment without convective buoyant forces is essential. The Comparative Soot Diagnostics (CSD) Experiment utilized the space shuttle's Glovebox Facility and a Near-Field and a Far-Field Module to gather data concerning the nature of smoke particulate as well as the effectiveness of an ionization and a light scattering detector in low gravity. Among the samples combusted in the Near-Field were paper, silicone rubber, kapton, Teflon and candles. Thermophoretic probes were inserted into the Near-Field to collect smoke which was later analyzed in a TEM to determine primary and aggregate size and distribution. The smoke from the Near-Field was ducted to the Far-Field where it passed through the two smoke detectors. Data from these experiments was analyzed to determine the effectiveness of the detectors with respect to particle size. Currently, experiments are in progress to provide more data concerning the efficacy of the detectors in a normal gravity environment.

**NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP
AND FELLOWSHIP PROGRAM**

**INVESTIGATION OF LOW MOLECULAR WEIGHT CARBOSILANES AS
LOW TEMPERATURE SINGLE SOURCE PRECURSORS FOR CHEMICAL
VAPOR DEPOSITION OF SINGLE CRYSTAL SILICON CARBIDE**

Michael A. Lienhard
Rensselaer Polytechnic Institute
Chemistry
Graduate, Ph.D.
Mentor: Dr. David J. Larkin

ABSTRACT

Silicon carbide (SiC) is a ceramic with high temperature semiconducting properties which is currently being developed for high temperature and high power microelectronic device applications. SiC epitaxial layers are currently produced at 1550°C by chemical vapor deposition (CVD) using silane and propane as the sources of silicon and carbon, respectively. An alternate approach involves the use of low molecular weight carbosilanes (organometallic molecules containing Si and C with a 1:1 ratio "built in") which have potential use as single-source CVD precursors to stoichiometric SiC. Additionally, these precursors potentially offer a low temperature route to SiC because they thermally decompose at relatively lower temperatures (<700°C) than those used in the conventional process (>1500°C). By investigating the pyrolysis chemistry of each precursor we hope to elucidate the dominating mechanistic pathways of decomposition that will ultimately lead to a lower temperature CVD route to epitaxial single crystal SiC.

NASA/OAI Collaborative Aerospace
Internship and Fellowship Program

Analysis and Processing of
Images from the DARTFire Project

Andrei C. Gnepp
Harvard University
Mathematics & Physics
Undergraduate, Junior
Mentor: Dr. Jay G. Horowitz

ABSTRACT

The DARTFire (Diffusive and Radiative Transfer in Fires) project has performed several experiments on combustion in microgravity. Small (2 cm) samples of plastic are burned under different gas flow and energy conditions. The flames are filmed by both infrared and XYBion cameras. Because of the internal structure of these cameras, however, the resulting images must be processed. For instance, the infrared camera has a rotating filter wheel that partially occludes the lens, even on the images marked “acceptable” by the camera. As another example, the XYBion camera’s automatic exposure system adjusts to the brightest spot in the image; unfortunately, thermocouples intended to measure the temperature of the flame often glow brighter than the flame itself. A general background on the DARTFire project will be given, and problems such as the above, along with their solutions, will be described.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP PROGRAM

Local Area Network Support

Thomas P. Kudla
Baldwin Wallace College
Computer Science
Undergraduate
Mentor: Mr. Robert Zalewski

A network support office is necessary to maintain a Local Area Network (LAN). The Engineering Directorate Support Office (EDSO) supports the Engineering Directorate's engineering specific computer environment. EDSO's goal is to create an environment which provides its users with the ability to achieve their maximum level of productivity. The basic parts of a network support office's job include network, hardware, and software support. Other tasks include end user training, research and evaluation of the future trends in hardware and software, data backup, and equipment maintenance.

NASA/OAI Collaborative Aerospace Internship and Fellowship Program

1 G Ignition and Flame Spread over a Thermally Thick Sample
in Opposed Flow.

Julie E. Kleinhenz

Case Western Reserve University

Aerospace Engineering

Undergraduate; Second Year

Kurt Sacksteder & Rick Pettegrew

The study of flame spread in microgravity is essential for the improvement of fire safety aboard the shuttle. Without the presence of buoyancy the fluid mechanics and heat transfer of the flame are altered. The OFFS experiments employs a low speed induced flow similar to that of the shuttle ventilation systems to study the propagation of flame over variable sample thicknesses. In order to successfully ignite the samples, an ignition technique had to be developed. By employing a prong arrangement it was possible to consistently ignite the samples. Flame propagation was heavily influenced by the fuel configuration. Results of ignition tests for several configurations will be discussed.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM

ISS Fluids and Combustion Facility Flow Test Support

Gail D. Jefferson
Spelman College/Georgia Institute of technology
Mathematics/Mechanical Engineering
Undergraduate Level: Senior
Mentor: Beth Curtis

ABSTRACT

The Space Station Fluids and Combustion Facility (FCF) is a modular facility housed in the US Laboratory Module of the International Space Station (ISS). This facility, slated to be fully operational by 2002, will remain an integral part of the ISS throughout the life of the Space Station. The FCF will provide a venue for fluid physics, combustion sciences and other science disciplines, that curtails the lofty expenses associated with research. The Engineering Directorate (ED) will design, analyze, assemble and test the hardware and software primarily located in the Core Rack, which provides a basis for the data processing required by the combustion and fluids experiments.

Although the temperature of each package will be controlled by drawing air off the air tree located in the base of the Core Rack, testing must be implemented to ensure that all of the closely packed electrical elements are sufficiently cooled. These flow tests will examine, through flow visualization and pressure drop measurements, the ability of the air tree, and if necessary the most effective supplemental device, needed to cool the drawer. In order to accurately perform the aforementioned tests without damaging the actual apparatus, models will be used. Therefore, mechanical measurements of each component which produce scaled drafts will be utilized to construct these models.

**NASA/OAI Collaborative Aerospace Internship and Fellowship Program
Research Symposium Session II
August 8-9, 1996**

Friday, August 9, 1996

ADMINISTRATION BUILDING (3), ROOM 215

- 9:15am** Katy Kao, "Advanced Subsonic Technology: Fuel Injector Analysis"
- 9:30am** Andy Krejsa, "Noise Exposure Management Program Presentation
Part I: Noise Surveys in Depth"
- 9:45am** Cynthia Shaw, "Noise Exposure Management Program Presentation
Part II: Personal Dosimetry in LeRC's Engine Research Building"
- 10:00am** Sonja Thomas, "Creating a Web Page"

BREAK

- 10:30am** Marcus Crawford, "Preparation of Polyimides for Strain -Gauge
Adhesive Application"
- 10:45am** Amanda Beeler, "Analysis of Radiative Ignition and Transition to
Spread Investigation (RITSI) GLovebox Experiment on USMP-3"
- 11:00am** David Jacobson, "Materials Synthesis Using Arcjets"
- 11:15am** Gordon Roberts, no title submitted
- 11:30am** Jason Terry, "World Wide Web - Database Integration"

ADJOURN

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM

FUEL INJECTOR PERFORMANCE ANALYSIS FOR
ADVANCED SUBSONIC PROGRAM

Katy C. Kao
University of California, Irvine
Chemical Engineering
Undergraduate
Mentor: Dr. Chi-Ming Lee

ABSTRACT

The performances of several fuel injectors have been evaluated for small and large engine applications against emissions. For the advanced civil subsonic aircraft engine, significant emission reduction in pollutants is required. Improved fuel injection and fuel/air mixing concepts need to be developed in order to meet the emission reduction requirement. This study is to develop a methodology to evaluate different fuel injector concepts to determine if the fuel injector meets the emission reduction requirement (i.e. EPA Parameter method.)

The U.S. Environmental Protection Agency emission standard for aircraft engines are expressed in terms of an integrated EPA parameter (EPAP). This parameter combines emission rates at the engine idle (7%), approach (30%), climb (85%), and take-off (100%) operating modes, integrated over a specific landing, take-off cycle.

Emission data at below 30% of actual engine power have been obtained from previous testing. Using regression methods, the emissions at 85% and 100% of actual engine operating power have been estimated. The fuel injectors which do not pass the methodology evaluation will not be tested in the future, due to high testing costs. The sampling of the emission data as well as the method used in determining the potential of the fuel injectors will be described.

**NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM**

**NOISE EXPOSURE MANAGEMENT PROGRAM PRESENTATION PART I:
AREA NOISE SURVEYS IN DEPTH**

Andrew M. Krejsa
The University of Dayton
Mechanical Engineering
Undergraduate
Mentor: Beth A. Cooper

ABSTRACT

Area noise surveys are a key part of the Noise Exposure Management Team's over all goals of satisfying NASA Lewis's occupational noise exposure policy and creating a safe environment for workers in a high noise area. From an area noise survey the Noise Exposure Management Team receives data that is necessary to analyze the hearing risk factor in that area. The data collected during an area noise survey indicates the dBA levels and NRR for that area. From this information, it is determined who is enrolled in the hearing conservation program, the proper signage for that area, and the minimum required hearing protect to be worn in that area. This presentation will include a comparative assessment of OSHA's standard on occupational noise and NASA Lewis's own policy on occupational noise, a review of the equipment involved in an area noise survey, a brief summary of how this equipment operates, and a step by step explanation of what is involved in an area noise survey including the personal interview and follow up procedures.

**NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM**

THE USE OF PERSONAL DOSIMETRY AT THE NASA LEWIS RESEARCH CENTER

Cynthia Ann Shaw
The Ohio State University
Environmental Science
Undergraduate, freshman
Mentor: Beth A. Cooper

Personal dosimetry is a process used by the Office of Environmental Programs, to ensure that the hearing of all of the workers at the Lewis Research Center is properly protected. A personal dosimeter is worn by selected workers, who encounter many different noise levels during an eight hour shift. The dosimeter, which is composed of a microphone linked to a microchip, then records the different noise levels. The dosimeter then can calculate the average noise level the worker is exposed to during their day. Finding the average noise level over an eight hour shift helps the Office of Environmental Programs to determine which level of hearing protection is best to properly protect the workers from hearing loss.

NASA/OAI COLLABORATIVE AEROSPACE INTERNSHIP AND FELLOWSHIP
PROGRAM

ANALYSIS OF RITSI (RADIATIVE IGNITION AND TRANSITION TO SPREAD
INVESTIGATION) GLOVEBOX EXPERIMENT ON USMP-3

Amanda J. Beeler
Ohio Northern University
Mechanical Engineering
Undergraduate, Junior
Mentor: Mrs. Sandra Olson

Fires in spacecraft pose a significant danger to the crew by poisoning the atmosphere with toxic products, producing gases that can lead to over-pressurization, and causing damage to critical electrical systems. RITSI (Radiative Ignition and Transition to Spread Investigation), a Middeck Glovebox combustion experiment run on STS-75 in March of 1996, was designed to study the controlling factors in the ignition process and the transition from ignition to a fire spread situation. Analysis of the data gathered by this experiment will increase scientists' understanding of fire spread in microgravity and therefore allow them to better prevent, control, and extinguish such fires. Data acquisition techniques include flame tracking using a computer-based video digitizing system and image processing software, correlation of 35mm pictures and video data, annotation and plotting of thermocouple digital displays, characterization of TEM grids and normal gravity testing. Due to the large quantities of data obtained, only observational and qualitative results such as trends in spread rates and the effect of the sample shape have been acquired thus far. Data analysis processes are further described as well as the significance of currently obtained results and future analysis plans.

**NASA/OAI COLLABORATIVE INTERNSHIP AND FELLOWSHIP
PROGRAM**

MATERIALS SYNTHESIS USING ARCJETS

David T. Jacobson
The Ohio State University
Mechanical Engineering
Undergraduate
Mentor: John M. Sankovic

ABSTRACT

An investigation has been conducted to determine if it is feasible to use NASA developed high-power arcjets as a plasma source for material synthesis by means of chemical vapor deposition. It has been demonstrated that high quality diamond films can be produced at a growth rate of 10×10^{-6} meters per hour using methane as a carbon source. Current research efforts include attempted synthesis of cubic boron nitride films as well as hexagonal boron nitride using BCL_3 as a boron source. The effects of methane concentration and substrate temperature on film quality are discussed.